Panasonic

PROGRAMMABLE CONTROLLER

FP7 TC Multi-analog Input Unit
FP7 RTD Input Unit
User's Manual

WUME-FP7TCRTD-01

Phone: 800.894.0412 - Fax: 888.723.4773 - Web: www.ctiautomation.net - Email: info@ctiautomation.net

Safety Precautions

Observe the following notices to ensure personal safety or to prevent accidents.
To ensure that you use this product correctly, read this User's Manual thoroughly before use.
Make sure that you fully understand the product and information on safety.
This manual uses two safety flags to indicate different levels of danger.

WARNING

If critical situations that could lead to user's death or serious injury is assumed by mishandling of the product.

-Always take precautions to ensure the overall safety of your system, so that the whole system remains safe in the event of failure of this product or other external factor.
-Do not use this product in areas with inflammable gas. It could lead to an explosion.
-Exposing this product to excessive heat or open flames could cause damage to the lithium battery or other electronic parts.

CAUTION

If critical situations that could lead to user's injury or only property damage is assumed by mishandling of the product.

-To prevent excessive exothermic heat or smoke generation, use this product at the values less than the maximum of the characteristics and performance that are assured in these specifications.
-Do not dismantle or remodel the product. It could cause excessive exothermic heat or smoke generation.
-Do not touch the terminal while turning on electricity. It could lead to an electric shock.
-Use the external devices to function the emergency stop and interlock circuit.
-Connect the wires or connectors securely.
The loose connection could cause excessive exothermic heat or smoke generation.
-Do not allow foreign matters such as liquid, flammable materials, metals to go into the inside of the product. It could cause excessive exothermic heat or smoke generation.
-Do not undertake construction (such as connection and disconnection) while the power supply is on. It could lead to an electric shock.

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Introduction

Thank you for buying a Panasonic product. Before you use the product, please carefully read the installation instructions and the users manual, and understand their contents in detail to use the product properly.

Types of Manual

- There are different types of users manual for the FP7 series, as listed below. Please refer to a relevant manual for the unit and purpose of your use.
- The manuals can be downloaded on our website.

Unit name or purpose of use	Manual name	Manual code
FP7 Power Supply Unit	FP7 CPU Unit Users Manual (Hardware)	WUME-FP7CPUH
FP7 CPU Unit		
	FP7 CPU Unit Command Reference Manual	WUME-FP7CPUPGR
	FP7 CPU Unit Users Manual (Logging Trace Function)	WUME-FP7CPULOG
	FP7 CPU Unit Users Manual (Security Function)	WUME-FP7CPUSEC
Instructions for Built-in LAN Port	FP7 CPU Unit Users Manual (LAN Port Communication)	WUME-FP7LAN
Instructions for Built-in COM Port	FP7 series Users Manual (SCU communication)	WUME-FP7COM
FP7 Extension Cassette (Communication) (RS-232C/RS485 type)		
FP7 Extension Cassette (Communication) (Ethernet type)	FP7 series Users Manual (Communication cassette Ethernet type)	WUME-FP7CCET
FP7 Extension (Function) Cassette Analog Cassette	FP7 Analog Cassette Users Manual	WUME-FP7FCA
FP7 Digital Input/Output Unit	FP7 Digital Input/Output Unit Users Manual	WUME-FP7DIO
FP7 Analog Input Unit	FP7 Analog Input Unit Users Manual	WUME-FP7AIH
FP7 Analog Output Unit	FP7 Analog Output Unit Users Manual	WUME-FP7AOH
FP7 Thermocouple Multi-analog Input Unit	FP7 Thermocouple Multi-analog Input Unit FP7 RTD Input Unit Users Manual	WUME-FP7TCRTD
FP7 RTD Input Unit		
FP7 High-speed counter Unit	FP7 High-speed counter Unit Users Manual	WUME-FP7HSC
FP7 Pulse Output Unit	FP7 Pulse Output Unit Users Manual	WUME-FP7PG
FP7 Positioning Unit	FP7 Positioning Unit Users Manual	WUME-FP7POSP
FP7 Serial Communication Unit	FP7 series Users Manual (SCU communication)	WUME-FP7COM
PHLS System	PHLS System Users Manual	WUME-PHLS
Programming Software FPWIN GR7	FPWIN GR7 Introduction Guidance	WUME-FPWINGR7

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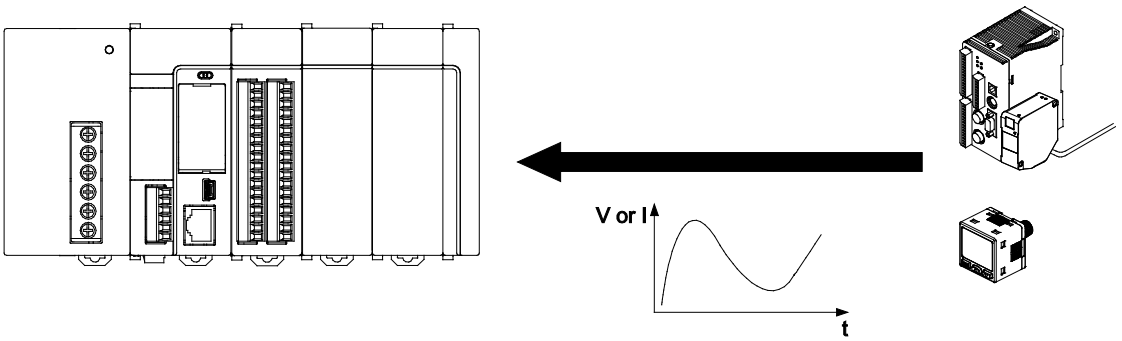
1

Unit Functions and Restrictions

1.1 Unit Functions and How They Work

1.1.1 Functions of Unit



■ **Analog input control is available in combination with the CPU unit.**

- Temperature data measured by a thermocouple or resistance temperature detector (RTD) is converted as digital values.

■ **Input with simple programs**

- For input data, digital conversion values are read as input devices (WX).
- At the time of the thermocouple input or the RTD input, temperatures are read as integer values in units of 0.1 degrees.

■ **Ten types of thermocouples and three types of RTDs are supported for each channel.**

- Ten types of thermocouples (K, J, T, N, R, S, B, E, PLII and WRe5-26) and three types of RTDs (Pt100, JPt100 and Pt1000) can be used. Also, on the thermocouple multi-analog input unit, they can be used in combination with volotage and current inputs.
- Types of temperature sensors can be changed by the settings of tool software or user programs.

■ **Various optional settings**

Functions to process loaded analog input data are provided. User programs can be simplified.

Function	Specifications
Average processing setting	Averages analog values obtained by sampling and stores them in the I/O area as digital values. It can be selected from No. of averaging times, time average and moving average.
Offset/Gain processing setting	Performs the correction of offset values (addition correct) or gain values (magnification correction), and stores the data after processing in the I/O area.
Scale conversion setting	(Only the voltage and current ranges of the thermocouple mult-analog input unit) The function makes it possible to convert values to an easy-to-use data range. Analog input data acquired in a range between preset minimum and maximum values is scale converted and stored in the I/O area. This function is convenient if used for scale unit conversion.
Upper/lower limit value comparison setting	This function compares acquired data with the upper limit and lower limit and turns ON the upper limit relay or lower limit relay if the acquired data exceeds the upper limit value or lower limit value.
Max./Min. hold setting	This function maintains the maximum and minimum values of acquired data. Holds the maximum and minimum digital conversion values when the maximum/minimum value hold setting is enabled, and stores the values in provided unit memories for each channel.
Disconnection detection	(Thermocouple multi-analog input unit) Turns ON the disconnection detection flag when input is disconnected or unconnected when selecting the thermocouple or the range of 1-5 V 4-20 mA, and warns of the error state. Also, in case of thermocouple, converts values to digital values in the range (K30000) which are different from those normally converted.
	(RTD input unit) When the A terminal and b terminal or B terminal and b terminal are disconnected, converts values to digital values in the range (K30000) which are different from those normally converted, and warns of the error state.

1.1.2 Unit Type and Product Number

Name	Specifications		Product No.
Thermocouple multi-analog input unit	8-ch input	Thermocouple input range: K1, K2, J1, J2, T, N, R, S, B, E, PLⅡ, WRe5-26 Voltage input range: -10 to +10 V, 0 to +5 V, 1 to +5 V, -100 to +100 mV Current input range: 0 to +20 mA, 4 to +20 mA	AFP7TC8
RTD input unit	8-ch input	RTD input range Pt100-1, Pt100-2, JPt100-1, JPt100-2, Pt1000	AFP7RTD8

1.2 Restrictions on Combinations of Units

1.2.1 Restrictions on Power Consumption

The internal current consumption of the unit is as follows. Make sure that the total current consumption is within the capacity of the power supply with consideration of all other units used in combination with this unit.

Name	Product No.	Consumption current
Thermocouple multi-analog input unit	AFP7TC8	80 mA or less
RTD input unit	AFP7RTD8	65 mA or less

1.2.2 Applicable Versions of Unit and Software

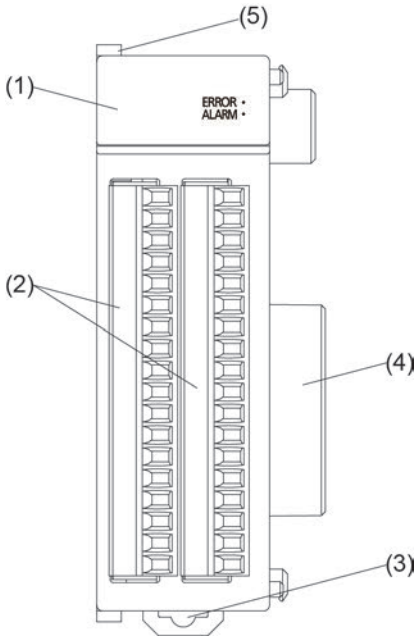
For using the above function cassettes, the following versions of unit and software are required.

Item	Applicable version
FP7 CPU unit	Ver.2.0 or later
Programmingn tool software FPWINGR7	Ver.2.2 or later

2

Names and Functions of Parts

2.1 Thermocouple Multi-analog Input Unit and RTD Input Unit



■ **Names and Functions of Parts**

(1) Operation monitor LEDs

LED name	LED color	Contents
-	Blue	Lit when the CPU unit is turned ON.
ERROR	Red	Lit when the configuration settings are beyond the allowable range or A/D conversion is not possible.
ALARM	Red	Lit when the hardware has an error.

(2) Analog input terminal block

The terminal block is removable. Remove the terminal block before wiring.

(3) DIN rail attachment lever

This lever is used to fix the unit to the DIN rail.

(4) Unit connector

Connects to other I/O units and highly-functional units.

(5) Fixing hook

This hook is used to secure the unit with another unit.

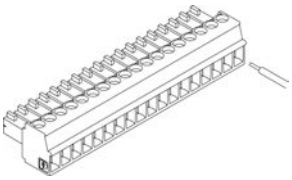
3
Wiring

3.1 Wiring of Terminal Block

3.1.1 Terminal Block, Suitable Wires and Tools

■ **Supplied terminal block and suitable wires**

A screw-down connection type is used for the terminal block. Use the following suitable wires for the wiring.



Terminal block socket

No. of pins	Phoenix Contact model No.	
	Part number	Product No.
18 pins	MC1,5/18-ST-3,5BK	1840528

Suitable wires (strand wire)

No. of wires	Size	Nominal cross-sectional area
1	AWG#28 to 16	0.08 mm^2 to 1.25 mm^2
2	AWG#28 to 20	0.08 mm^2 to 0.5 mm^2

Pole terminals with compatible insulation sleeve

If a pole terminal is being used, the following models (made by Phoenix Contact) should be used.

Manufacturer	Cross-sectional area	Size	Phoenix Contact Par No.	
			With insulating sleeve	Without insulating sleeve
Phoenix Contact	0.25 mm^2	AWG#24	AI 0,25-6 BU	A 0,25-7
	0.34 mm^2	AWG#22	AI 0,34-6TQ	A 0,34-7
	0.50 mm^2	AWG#20	AI 0,5-6 WH	A 0,5-6
	0.75 mm^2	AWG#18	AI 0,75-6 GY	A 0,75-6
	1.00 mm^2	AWG#16	-	A 1-6
	0.5 mm^2×2	AWG#20×2	AI-TWIN 2X 0,5-8 WH	-

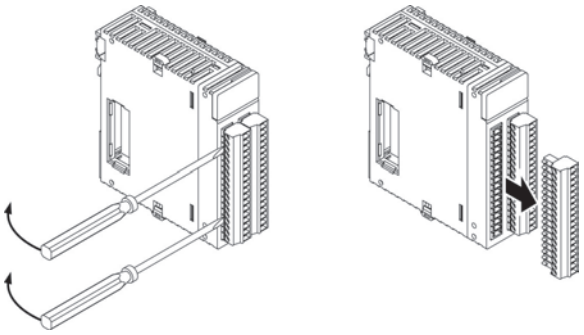
Pressure welding tool for pole terminals

Manufacturer	Phoenix Contact model No.	
	Part number	Product No.
Phoenix Contact	CRIMPFOX 6	1212034

3.1.2 Wiring

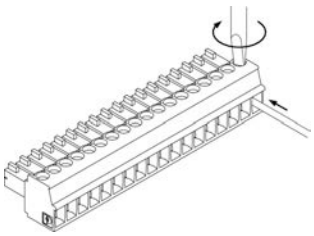
■ **Wiring method**

(1) Insert a screwdriver between the terminal block and the case, and remove the terminal block.

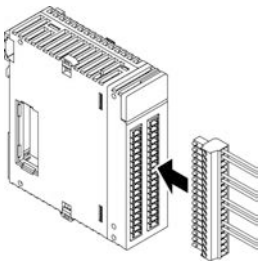


(2) Remove a portion of the wire's insulation.

(3) Insert the wire into the terminal block until it contacts the back of the block socket, and then tighten the screw clockwise to fix the wire in place.



(4) Fit the terminal block into the unit securely.



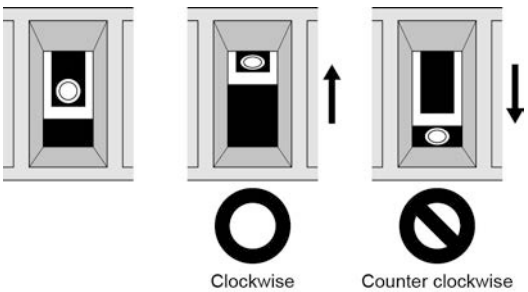
■ Tightening the terminal block

- When tightening the terminals of the terminal block, use a screwdriver (Phoenix Contact, Product No. 1205037) with a blade size of 0.4 x 2.5 (Part No. SZS 0,4x2,5).
- The tightening torque should be 0.22 to 0.25 N·m.

■ Precautions on wiring

The following precautions should be observed, to avoid broken or disconnected wires.

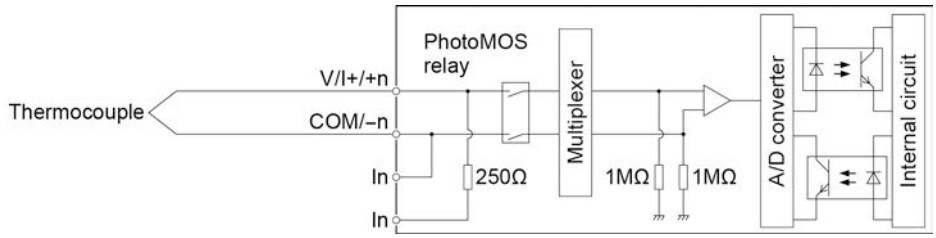
- When removing the wire's insulation, be careful not to scratch the core wire.
- Do not twist the wires to connect them.
- Do not solder the wires to connect them. The solder may break due to vibration.
- After wiring, make sure stress is not applied to the wire.
- In the terminal block socket construction, if the wire is fastened upon counter-clockwise rotation of the screw, the connection is faulty. Disconnect the wire, check the terminal hole, and then re-connect the wire.



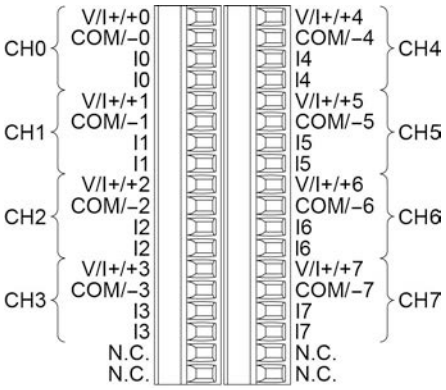
3.2 Connection of Thermocouple Multi-analog Input Unit

3.2.1 For Thermocouple Input

■ **Wiring Diagram and Internal Circuit Diagram**



■ **Terminal layout**



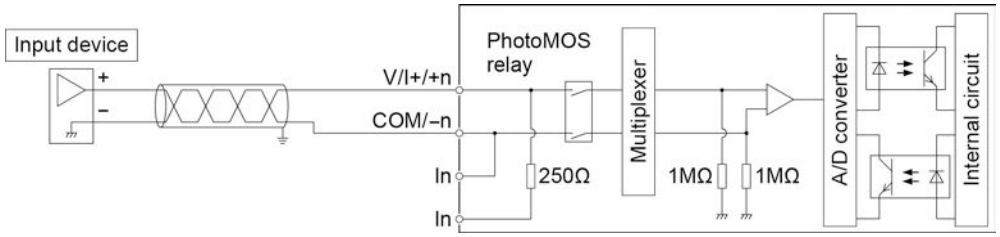
(Note) Do not connect anything to N.C terminals.

◆ **NOTES**

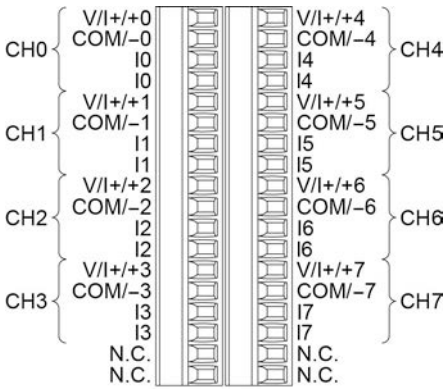
- **Connect wires in accordance with the polarity of he thermocouple. Also, when extending the signal line of the thermocouple, use the compensating lead wire for the used thermocouple. It is recommended to ground the unit using the shielded compensating lead wire.**
- **Do not have the analog input wiring close to AC wires, power wires, or load line from a device other than PLC. Also, do not bundle it with them.**

3.2.2 For Voltage Input

■ **Wiring Diagram and Internal Circuit Diagram**



■ **Terminal layout**



(Note) Do not connect anything to N.C terminals.

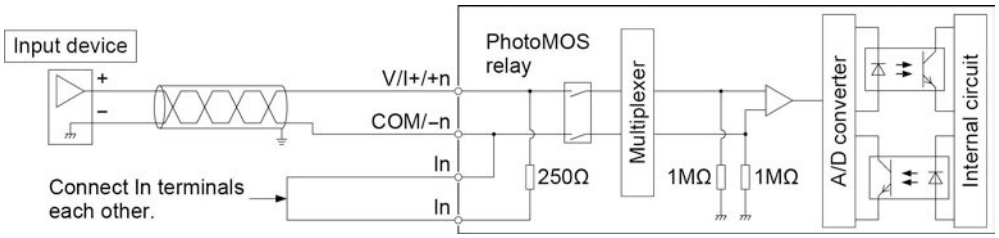
◆ **NOTES**

- **Use double-core twisted-pair shielded wires. It is recommended to ground them. However, depending on the conditions of the external noise, it may be better not to ground the shielding.**
- **Do not have the analog input wiring close to AC wires, power wires, or load line from a device other than PLC. Also, do not bundle it with them.**

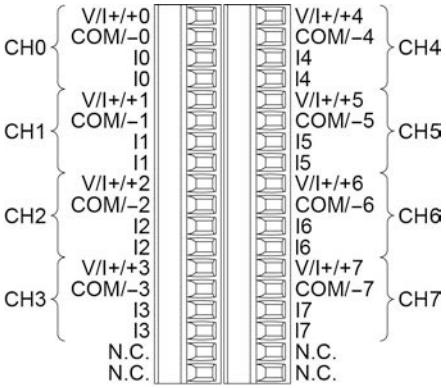
3.2.3 For Current Input

■ **Wiring Diagram and Internal Circuit Diagram**

In case of the current input, connect In terminals each other.



■ **Terminal layout**



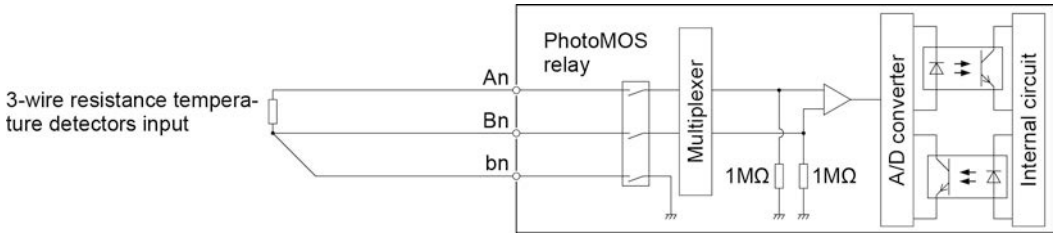
(Note) Do not connect anything to N.C terminals.

◆ **NOTES**

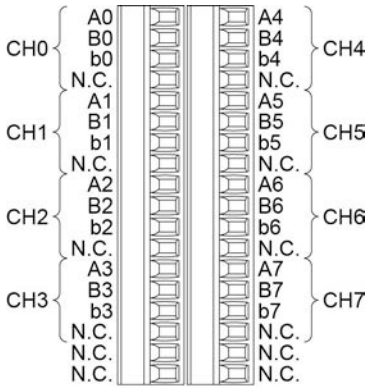
- **Use double-core twisted-pair shielded wires. It is recommended to ground them. However, depending on the conditions of the external noise, it may be better not to ground the shielding.**
- **Do not have the analog input wiring close to AC wires, power wires, or load line from a device other than PLC. Also, do not bundle it with them.**

3.3 Connection of RTD Input Unit

■ **Wiring Diagram and Internal Circuit Diagram**



■ **Terminal layout**



(Note) Do not connect anything to N.C terminals.

◆ **NOTES**

- **For copper wires for wiring, use thick wires having insulation performance of JISC3307 and JISC3401 or equivalents to prevent a large increase in the electric resistance. It is recommended to ground the unit using the shielded compensating lead wire.**
- **Do not have the analog input wiring close to AC wires, power wires, or load line from a device other than PLC. Also, do not bundle it with them.**

4

Unit Settings and Data Reading

4.1 Confirming the I/O Number Allocations and Starting Word Number

4.1.1 Occupied I/O Area and I/O Allocation

- Input data is allocated to the external input relay areas (WX).
- To the I/O areas of the thermocouple multi analog input unit and RTD input unit, an area to set optional functions and an area to reset errors are allocated.

■ **Input contact**

I/O area No.	Name	Default	Description
WX0	CH0 Analog conversion data	K0	Analog conversion data area Digital conversion values corresponding to analog input are stored as 16-bit signed integer data. Stored values vary by ranges. When optional average processing, scale conversion, offset/gain processing has been set, data after the processing is stored. Optional function flag area Refer to the next page.
WX1	CH0 Optional function flag	H0	
WX2	CH1 Analog conversion data	K0	
WX3	CH1 Optional function flag	H0	
WX4	CH2 Analog conversion data	K0	
WX5	CH2 Optional function flag	H0	
WX6	CH3 Analog conversion data	K0	
WX7	CH3 Optional function flag	H0	
WX8	CH4 Analog conversion data	K0	
WX9	CH4 Optional function flag	H0	
WX10	CH5 Analog conversion data	K0	
WX11	CH5 Optional function flag	H0	
WX12	CH6 Analog conversion data	K0	
WX13	CH6 Optional function flag	H0	
WX14	CH7 Analog conversion data	K0	
WX15	CH7 Optional function flag	H0	

(Note 1): The I/O numbers in the table indicates offset addresses. The I/O numbers actually allocated are the numbers based on the starting word number allocated to the unit. Example) When the starting word number for the unit is "10", the A/D conversion data of CH0 is WX10 and the error flag is X11F.

■ Input contact (Optional functions/Error flag area)

I/O number								Name	Description
CH0	CH1	CH2	CH3	CH4	CH5	CH6	CH7		
X10	X30	X50	X70	X90	X110	X130	X150	Disconnection detection flag	ON with disconnection detected and OFF with disconnection restored. (Valid for thermocouple, voltage:1-5 V and current: 4-20 mA ranges only)
X11	X31	X51	X71	X91	X111	X131	X151	Upper limit comparison relay	Turns ON when the value exceeds the set upper limit.
X12	X32	X52	X72	X92	X112	X132	X152	Lower limit comparison relay	Turns OFF when the value drops below the set lower limit.
X13	X33	X53	X73	X93	X113	X133	X153	Upper/Lower limit comparison execution flag	Turns ON when the upper limit/lower limit comparison function is executed.
X14	X34	X54	X74	X99	X114	X134	X154	Not used	Do not use.
X15	X35	X55	X75	X95	X115	X135	X155	Max./Min. hold execution flag	Turns ON when the max./min. hold function is executed.
X16 to X1E	X36 to X3E	X56 to X5E	X76 to X7E	X96 to X9E	X116 to X11E	X136 to X13E	X156 to X15E	Not used	Do not use.
X1F	X3F	X5F	X7F	X9F	X11F	X13F	X15F	Error flag	Turns ON when an error occurs

(Note 1): The I/O numbers in the table indicates offset addresses. The I/O numbers actually allocated are the numbers based on the starting word number allocated to the unit. Example) When the starting word number for the unit is "10", the C error flag is X11F.

■ Output flag

I/O number								Name	Description
CH0	CH1	CH2	CH3	CH4	CH5	CH6	CH7		
Y0	Y10	Y20	Y30	Y40	Y50	Y60	Y70	Disconnection detection execution relay	ON to execute the disconnection detection function. OFF to turn OFF the disconnection detection flag (Xn0). (Valid for thermocouple, voltage:1-5 V and current: 4-20 mA ranges only)
Y1	Y11	Y21	Y31	Y41	Y51	Y61	Y71	Not used	Do not use.
Y2	Y12	Y22	Y32	Y42	Y52	Y62	Y72		
Y3	Y13	Y23	Y33	Y43	Y53	Y63	Y73	Upper/Lower limit comparison execution relay	ON to execute the function to compare the upper and lower limits. OFF to turn OFF the upper limit comparison relay (Xn1) and lower limit comparison relay (Xn2).
Y4	Y14	Y24	Y34	Y44	Y54	Y64	Y74	Not used	Do not use.
Y5	Y15	Y25	Y35	Y45	Y55	Y65	Y75	Max./Min. hold execution relay	ON to execute the max./min. hold function.
Y6 to YE	Y16 to Y1E	Y26 to Y2E	Y36 to Y3E	Y46 to Y4E	Y56 to Y5E	Y66 to Y6E	Y76 to Y7E	Not used	Do not use.
YF	Y1F	Y2F	Y3F	Y4F	Y5F	Y6F	Y7F	Error flag reset relay	Resets an error flag.

(Note 1): The I/O numbers in the table indicates offset addresses. The I/O numbers actually allocated are the numbers based on the starting word number allocated to the unit. Example) When the starting word number for the unit is "10", the disconnection detection execution relay of CH0 is Y100, and the error flag reset relay is Y10F.

4.1.2 Confirming Allocation of I/O Numbers

- The I/O numbers and base word numbers are always necessary when creating programs. Always check to see if the numbers match the design.
- The I/O numbers allocated to the analog input unit are determined by the starting word numbers.

■ **Allocation method**

Take the following procedure to set the starting word number.

◆ **PROCEDURE**

1. **Select "Options" > "FP7 Configuration" in the menu bar.**
2. **Select "I/O map" in the field.**
3. **Double-click the target slot where the operating unit is to be inserted.**
4. **Select "Thermocouple Multi-analog Input Unit" or "RTD Input Unit" in the field of "Select unit to use".**
5. **Press the [OK] button.**

   The specified starting word number is set.

4.2 Configuration Settings

4.2.1 Unit Configuration

The settings for the unit such as input range, channels to be converted and optional functions are specified in the configuration menu of tool software.

■ **Setting method**

The following procedure describes the process when the thermocouple multi-analog input unit or RTD input unit has been already allocated in the I/O map.

◆ **PROCEDURE**

1. **Select "Options" > "FP7 Configuration" in the menu bar.**
2. **Select "I/O Map" in the field.**
3. **Select the slot where the unit has been registered, and press the "Advanced" button.**

   "Thermocouple multi-analog input unit" or "RTD input unit" setting dialog box is displayed.
4. **Select items according to the conditions used.**

   Select optional settings as necessary.
5. **Press the [OK] button.**

   The set values will be effective when they are downloaded with programs as a project.

■ Settings

Group	Setting item		Settings	Default
Basic setting item (Common)	Power frequency		60Hz/50Hz	60 Hz
	Conversion time (Note)		25ms/5ms	25 ms
Basic setting item (for each channel)	Conversion processing		Execute/Not execute	Execute
	Range setting (TC unit)	Thermocouple	K1 (-100.0 to 600.0 °C) K2 (-200.0 to 1000.0 °C) J1 (-100.0 to 400.0 °C) J2 (-200.0 to 750.0 °C) T (-270.0 to 400.0 °C) N (-270.0 to 1300.0 °C) R (0.0 to 1760.0 °C) S (0.0 to 1760.0 °C) B (0.0 to 1820.0 °C) E (-270.0 to 1000.0 °C) PLⅡ (0.0 to 1390.0 °C) WRe5-26 (0.0 to 2315.0 °C)	-10 to +10 V
		Voltage	-10 to +10 V 0 to +5 V +1 to +5 V -100 to +100 mV	
		Current	0 to +20 mA +4 to +20 mA	
	Range setting (RTD unit)		Pt100-1 (-100.0 to 200.0 °C) Pt100-2 (-200.0 to 650.0 °C) JPt100-1 (-100.0 to 200.0 °C) JPt100-2 (-200.0 to 650.0 °C) Pt1000 (-100.0 to 100.0 °C)	Pt100-1 (-100.0 to 200.0 °C)

(Note) Conversion time can be set only when selecting the thermocouple multi-analog input unit.

■ **Settings**

Group	Setting item	Settings	Default
Optional setting item (For each CH)	Average processing settings	Not execute/No. of averaging times/Time average/Moving average	Not execute
	Offset/Gain processing	Not execute/Execute	Not execute
	Scale conversion(Note)	Not execute/Execute	Not execute
	Upper/Lower limit comparison	Not execute/Execute	Not execute
	Max./Min. hold	Not execute/Execute	Not execute
	Disconnection detection	Not execute/Execute	Not execute
	Disconnection detection reset	Auto/Manual	Auto
	Averaging constant	No. of times: 2 to 60000 [times]	8
		Time: 200 to 60000 [ms]	200
		Moving: 3 to 64 [times]	8
	Offset value	-3000 to +3000	0
	Gain value	+9000 to +11000	+10000
	Maximum value of scale conversion (Note)	-30000 to +30000	+10000
	Minimum value of scale conversion (Note)	-30000 to +30000	0
	Upper limit comparison ON level	-31250 to +31250	+1000
	Upper limit comparison OFF level	-31250 to +31250	+1000
	Lower limit comparison ON level	-31250 to +31250	0
	Lower limit comparison OFF level	-31250 to +31250	0

(Note) Scale conversion can be set only when selecting voltage or current range in the thermocouple multi-analog input unit.

4.2.2 Unit Setting and Conversion Processing Time

Conversion time varies with the configuration setting conditions.

■ Unit's conversion process cycle time

- The unit's conversion time is determined by the number of channels that the conversion process is executed.
- For the thermocouple multi-analog input unit, a conversion time per channel can be selected.

Normal mode (When conversion time is 25 ms/ch)		**High-speed mode (When conversion time is 5 ms/ch) (Note 2)**	
No. of executed channels (Note 1)	**Conversion time + Processing time**	**No. of executed channels (Note 1)**	**Conversion time + Processing time**
1	25 ms + 25 ms	1	5 ms + 5 ms
2	50 ms + 25 ms	2	10 ms + 5 ms
3	75 ms + 25 ms	3	15 ms + 5 ms
4	100 ms + 25 ms	4	20 ms + 5 ms
5	125 ms + 25 ms	5	25 ms + 5 ms
6	150 ms + 25 ms	6	30 ms + 5 ms
7	175 ms + 25 ms	7	35 ms + 5 ms
8	200 ms +25 ms	8	40 ms + 5 ms

(Note 1) Channels to execute the conversion processing are set in the unit memories (UM00080/UM00090/UM000A0/UM000B0/UM000C0/UM000D0/UM000E0/UM000F0).

(Note 2) Conversion time can be set only when selecting the thermocouple multi-analog input unit. It is set in the unit memory (UM00071).

■ Normal mode and High-speed mode

- In the normal mode (conversion time: 25 ms/c), a process is available to reduce the effects of commercial frequency (50Hz/60Hz) noises by a digial filter. In the high-speed mode (conversion time: 5 ms/ch), this process is not available.
- When there are effects of commercial frequency (50Hz/60Hz) noises, it is recommended to use the normal mode.

■ Conversion processing execution/non-execution setting and conversion processing time

Select the execution or non-execution of the conversion processing of analog input on a channel-by-channel basis. This can save the conversion time for channels that do not execute conversion processing.

Example) Conversion time for two channels (with CH2 to CH7 excluded)

Conversion is executed in the order of ch0→ch1→ch0→ch1→ch0→ch1→ch0→ch1→.., and the conversion time for CH2 to CH7, which are excluded, is saved.

4.3 Reading Analog Input Data

4.3.1 Reading Analog Input Data

■ **Basic operation of analog input processing**

(1) Receiving analog input

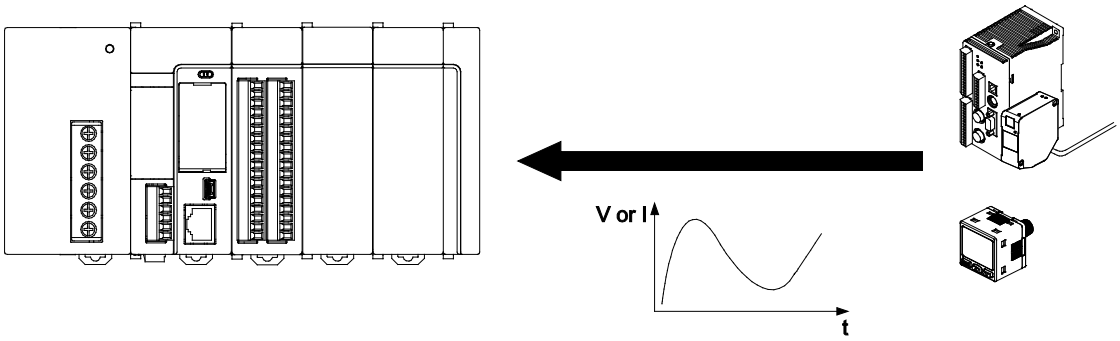
The input part of the unit receives analog input data from the thermocouple, RTD or external devices.

(2) Digital conversion processing

Analog input data received by the unit is converted into digital values in sequence automatically in the unit. The converted digital value varies with the setting of the range.

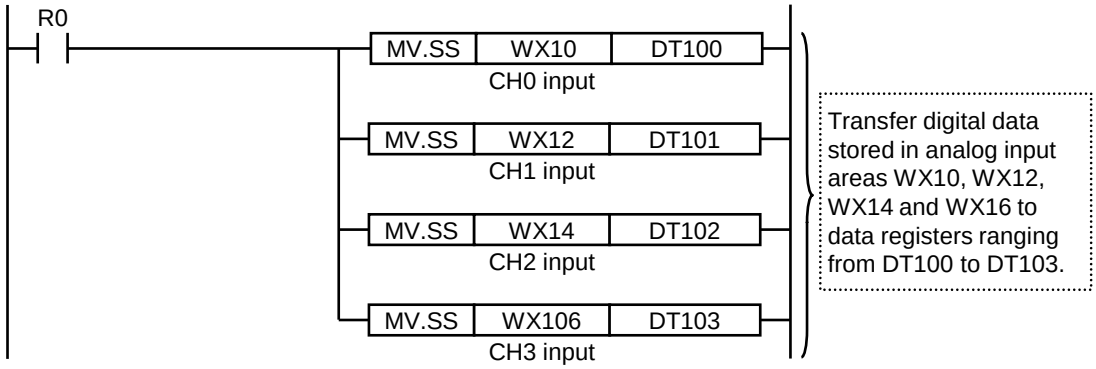
(3) Storage of digital values

A user program is used to read converted digital values as data in the unit relay area (WX). The specified area number varies depending on the installation position of the unit.



■ **Program to acquire converted digital values**

Reading the values in digital conversion value storage areas WX10, WX12, WX14, and WX16 to any areas of data registers ranging from DT100 to DT103.


R0
MV.SS WX10 DT100
CH0 input
MV.SS WX12 DT101
CH1 input
MV.SS WX14 DT102
CH2 input
MV.SS WX106 DT103
CH3 input
Transfer digital data stored in analog input areas WX10, WX12, WX14 and WX16 to data registers ranging from DT100 to DT103.

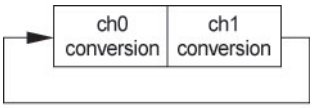
4.4 Data Acquisition Timing

■ Input conversion processing time of the unit

Conversion processing time varies with the range and the number of channels in use. The conversion execution/non-execution channel function can save the conversion time for channels that do no execute conversion processing.

Example of 2-channel conversion

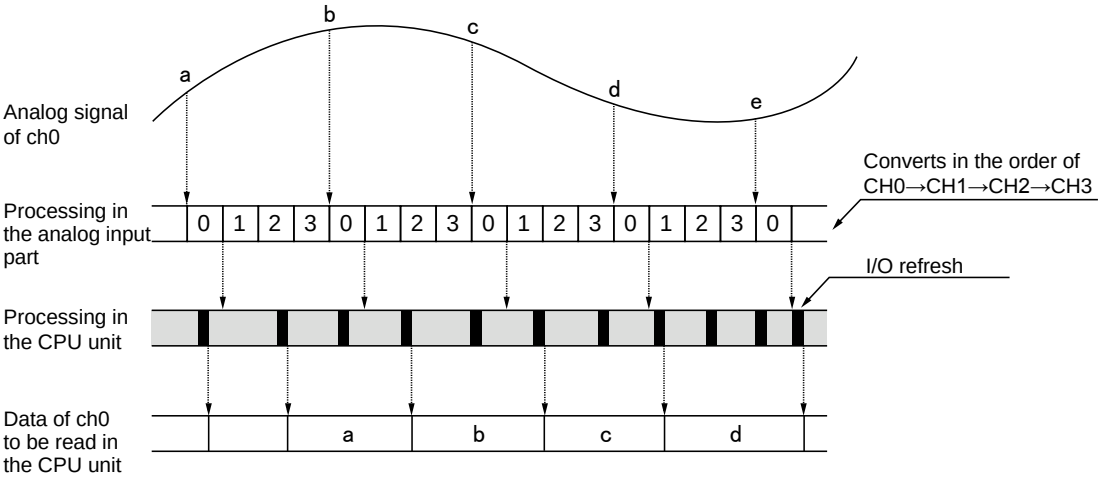
Converted in the order of ch0→ch1→ch0→ch1→...



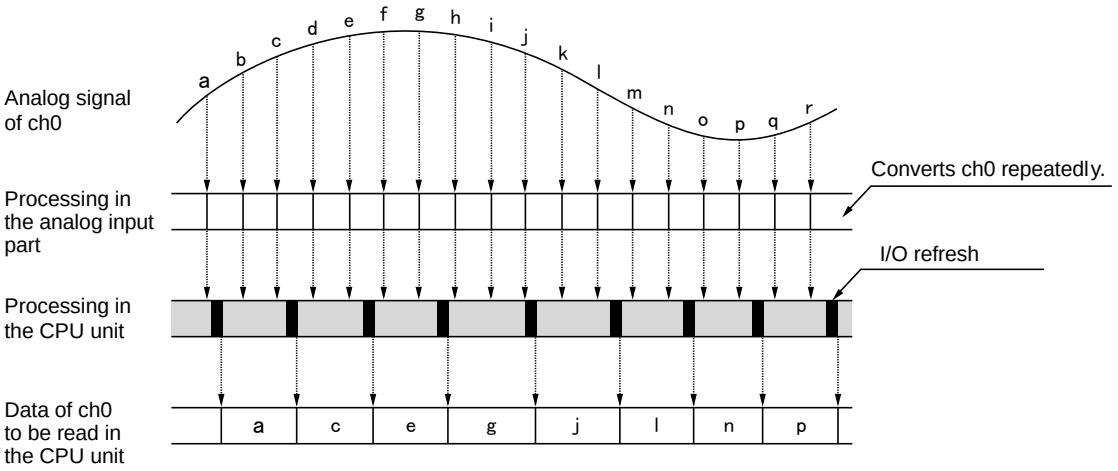
■ Data acquisition timing of CPU unit

- Digital values converted by the unit are input into the CPU unit at the I/O refreshing timing of the CPU unit.
- The conversion processing of the analog input unit is not synchronized with the I/O refreshing timing of the CPU unit. Therefore, the latest data is input into the operation memory of the CPU unit when the CPU unit implements I/O refreshing.

Example of 4-channel conversion



Example of 1-channel conversion



5

Conversion Characteristics of Analog Input

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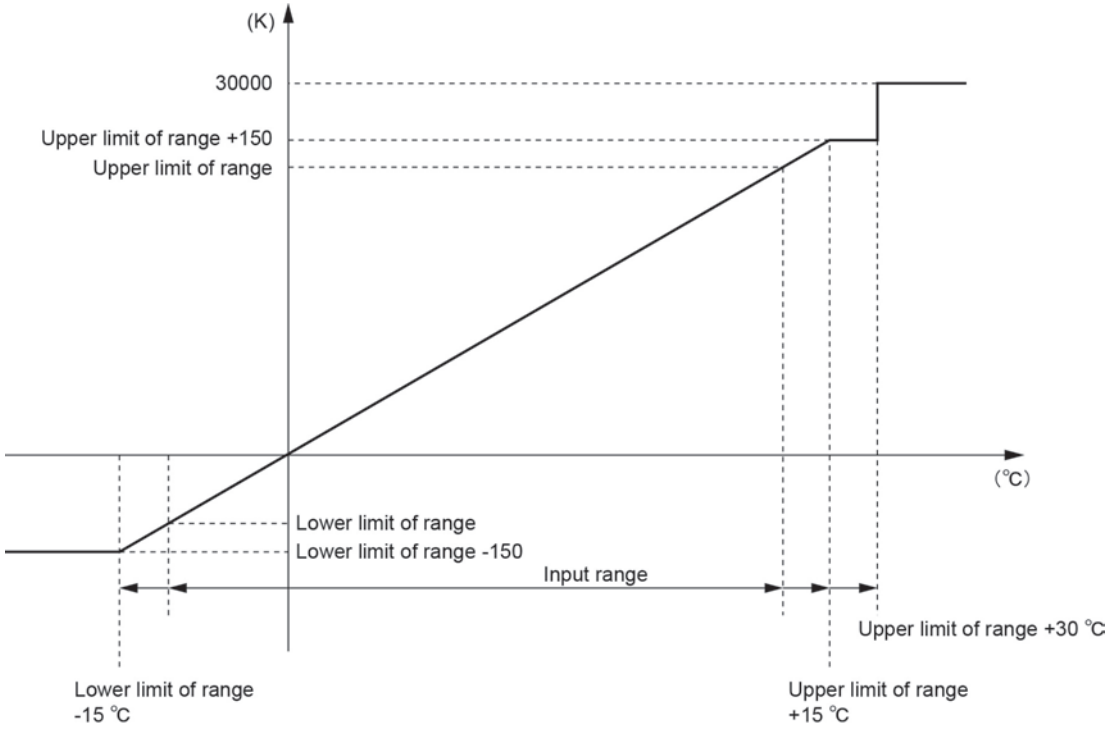
5.1 Input Conversion Characteristics (AFP7TC8)

5.1.1 Thermocouple Input Range

■ **Conversion characteristics graph**



■ **When exceeding the rated range**

- Up to the lower limit -15 °C and the upper limit +15 °C of the range, reference values which the conversion accuracy is not assured are indicated.
- When exceeding the upper limit of the range +30 °C, converted values are "30000".

Range	Input value	Converted value
K1 (Thermocouple type K)	-115 °C or less	-1150
	+615 °C or more	+6150
K2 (Thermocouple type K)	-215 °C or less	-2150
	+1015 °C or more	+10150
J1 (Thermocouple type J)	-115 °C or less	-1150
	+415 °C or more	+4150
J2 (Thermocouple type J)	-215 °C or less	-2150
	+765 °C or more	+7650
Thermocouple type T	-285 °C or less	-2850
	+415 °C or more	+4150
Thermocouple type N	-285 °C or less	-2850
	+1315 °C or more	+13150
Thermocouple type R	-15 °C or less	-150
	+1775 °C or more	+17750
Thermocouple type S	-15 °C or less	-150
	+1775 °C or more	+17750
Thermocouple type B	-15 °C or less	-150
	+1835 °C or more	+18350
Thermocouple type E	-285 °C or less	-2850
	+1015 °C or more	+10150
Thermocouple type PL Ⅱ	-15 °C or less	-150
	+1405 °C or more	+14050
Thermocouple type WRe5-26	-15 °C or less	-150
	+2330 °C or more	+23300
Disconnection	-	+30000

5.1.2 Voltage Input Range

■ **-10 V to 10 V DC input (0.32 mV, 1/62500)**

Conversion characteristics graph

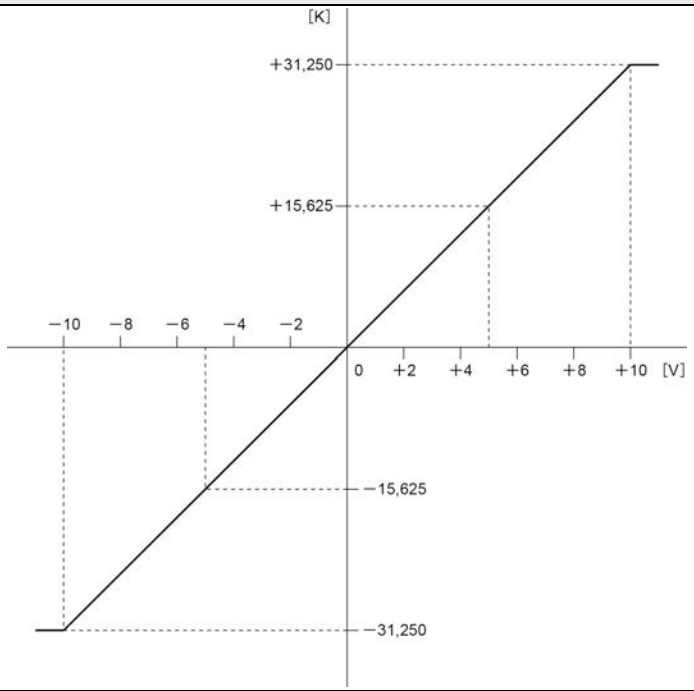


Table of A/D converted values

Input voltage (V)	Digital value
10	+31250
8	+25000
6	+18750
4	+12500
2	+6250
0	0
-2	-6250
-4	-12500
-6	-18750
-8	-25000
-10	-31250

When exceeding the rated range

Input voltage (V)	A/D converted value
10 V or more	+31250
10 V or more	-31250

■ **0 V to 5 V DC input (0.16mV, 1/31250)**

Conversion characteristics graph

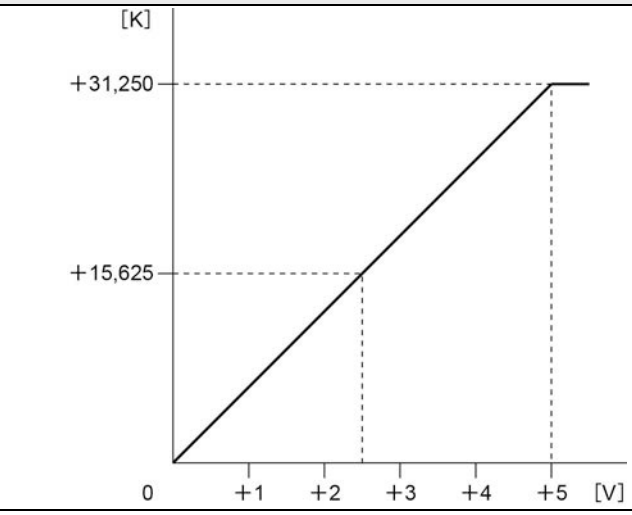


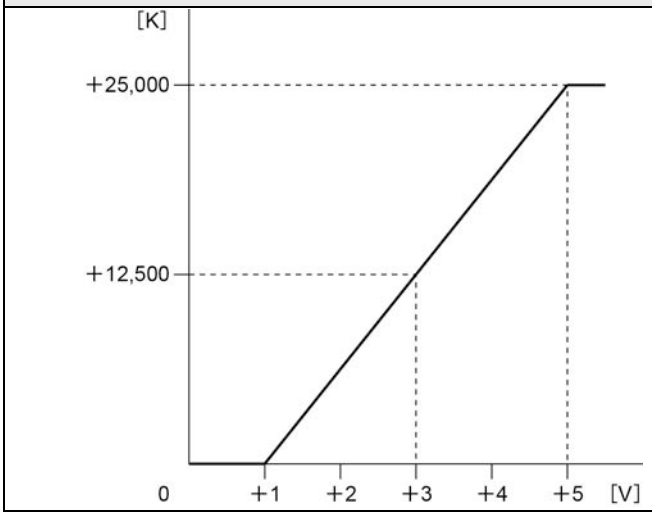
Table of A/D converted values

Input voltage (V)	Digital value
+5	+31250
+4	+25000
+3	+18750
+2	+12500
+1	+6250
0	0

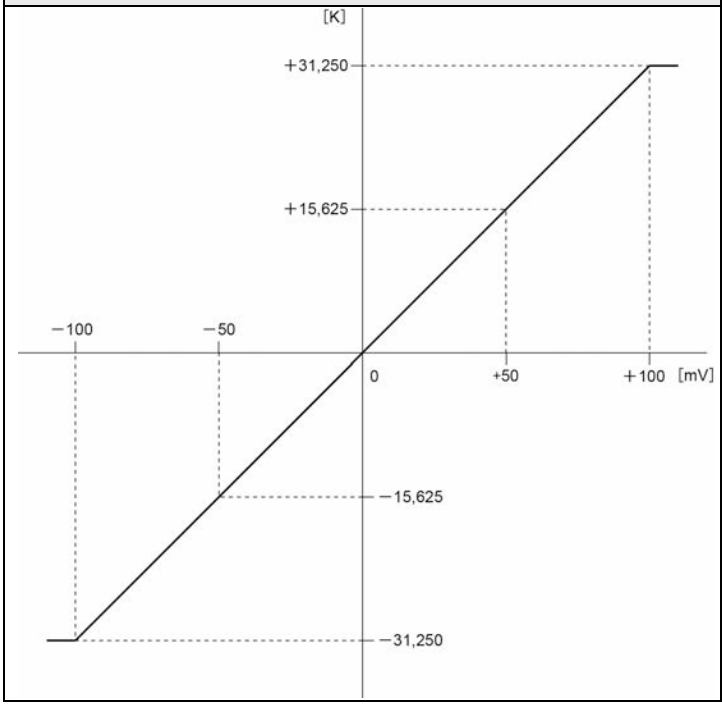
When exceeding the rated range

Input voltage (V)	A/D converted value
+5 V or more	+31250
0 V or less	0

■ **1 V to 5 V DC input (0.16 mV, 1/25000)**

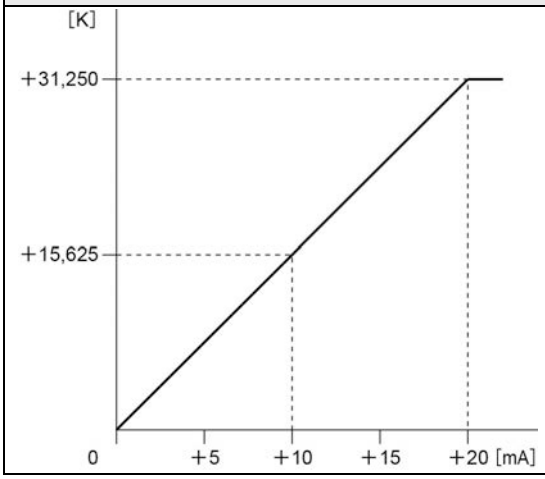
Conversion characteristics graph	Table of A/D converted values	
	Input voltage (V)	Digital value
	+5	+25000
	+4	+18750
	+3	+12500
	+2	+6250
	+1	0
	When exceeding the rated range	
	Input voltage (V)	A/D converted value
	+5 V or more	+25000
	+1 V or less	0

■ **-100 mV to +100 mV DC input (3.2 μV, 1/62500)**

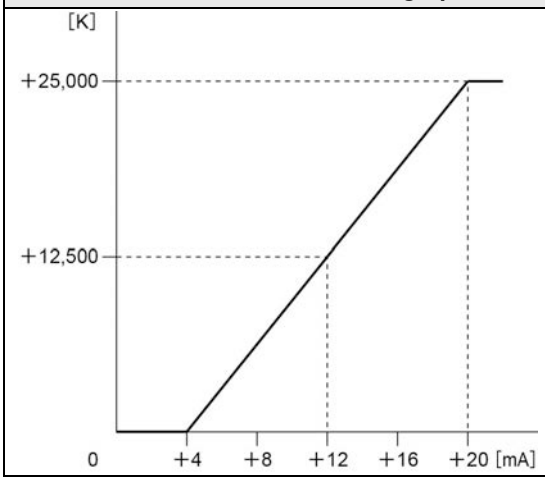
Conversion characteristics graph	Table of A/D converted values	
	Input voltage (mV)	Digital value
	100	+31250
	80	+25000
	60	+18750
	40	+12500
	20	+6250
	0	0
	-20	-6250
	-40	-12500
	-60	-18750
	-80	-25000
	-100	-31250
	When exceeding the rated range	
	Input voltage (V)	A/D converted value
	+100 mV or more	+31250
	-100 mV or less	-31250

5.1.3 Current Input Range

■ **0 mA to 20 mA DC input (0.64 μA, 1/31250)**

Conversion characteristics graph	Table of A/D converted values	
	Input current (mA)	Digital value
	+20	+31250
	+16	+25000
	+12	+18750
	+8	+12500
	+4	+6250
	0	0
	When exceeding the rated range	
	Input current (mA)	Digital value
	20 mA or more	+31250
	0 mA or less (Negative value)	0

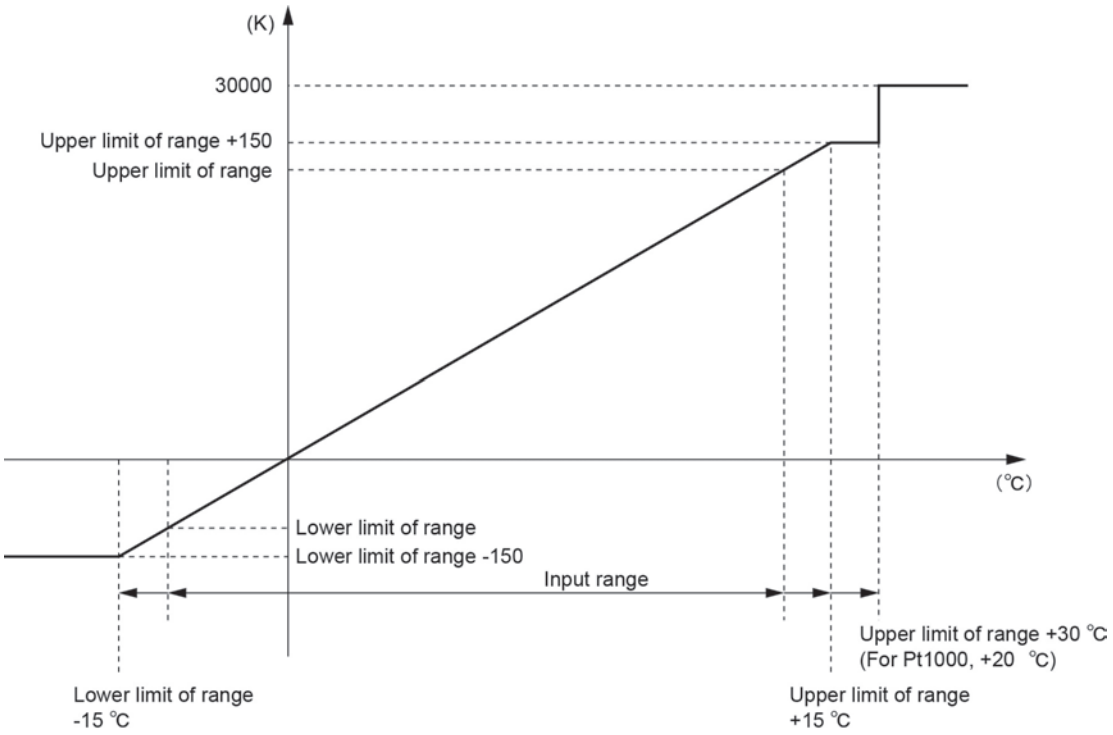
■ **4 mA to 20 mA DC input (0.64 μA, 1/25000)**

Conversion characteristics graph	Table of A/D converted values	
	Input current (mA)	Digital value
	+20	+25000
	+16	+18750
	+12	+12500
	+8	+6250
	+4	0
	When exceeding the rated range	
	Input current (mA)	Digital value
	20 mA or more	+25000
	4 mA or less	0

5.2 Input Conversion Characteristics (AFP7RTD8)

5.2.1 RTD Input Range

■ **Conversion characteristics graph**



■ **When exceeding the rated range**

☛ To the next page

■ **When exceeding the rated range**

- Up to the lower limit -15 °C and the upper limit +15 °C of the range, reference values which the conversion accuracy is not assured are indicated.
- When exceeding the upper limit of the range +30 °C, converted values are "3000". In the case of Pt1000, it is +20 °C.

Range	Input value	Converted value
Pt100	-215 °C or less	-2150
	+665 °C or more	+6650
Pt100	-115 °C or less	-1150
	+215 °C or more	+2150
JPt100	-215 °C or less	-2150
	+665 °C or more	+6650
JPt100	-115 °C or less	-1150
	+215 °C or more	+2150
Pt1000	-115 °C or less	-1150
	+115 °C or more	+1150
Disconnection	-	+30000

6

Optional settings

6.1 Average Processing Settings

6.1.1 Number of Averaging Times

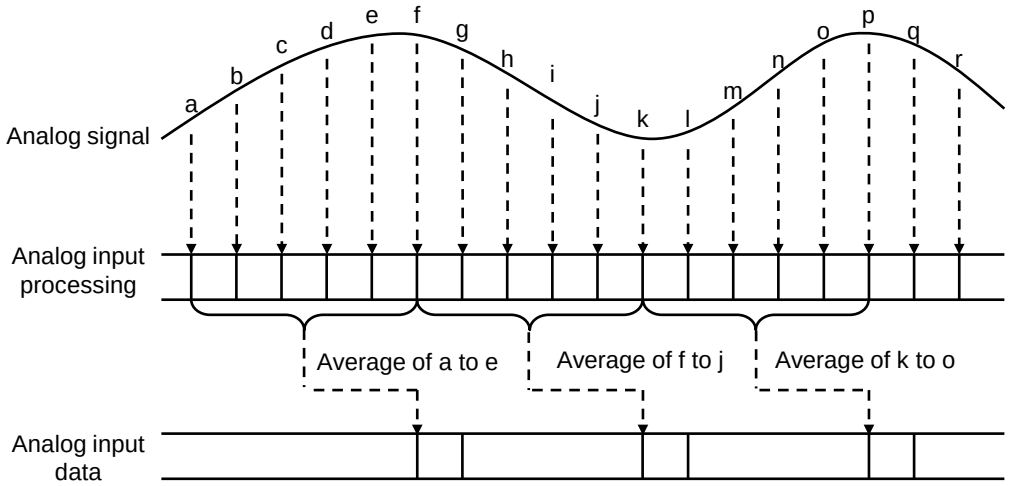
■ Overview of functions

- Analog input data sampled by the unit is averaged and stored as digital values.
- If the number of averaging time is set, analog input data items acquired will be stored in unit memory (UM) as digital values when the number of analog input data items reaches the set number of averaging times.
- If the number of data items acquired is less than the number of averaging times, the first acquired data will be stored in the I/O area.
- Obtain the number of averaging times to be processed from the following input.

Input	The sum of analog input data items for the number of averaging times
Output	Number of averaging times value

■ Processing during the number of averaging times

Averaging setting example: The number of averaging times is set to 5.



■ Configuration

Name		Default	Setting range and description
Function setting	Average processing	Not execute	Select "the number of averaging times".
	Averaging constant	K8	Number: 2 to 60000 [times] (specified with an unsigned integer)

6.1.2 Time Average

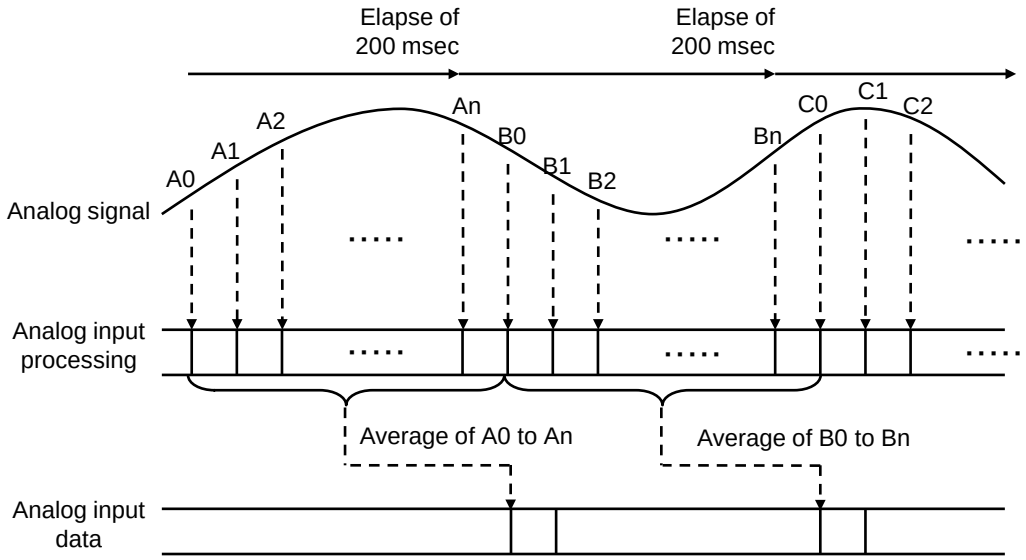
■ Overview of functions

- Analog input data sampled by the unit is averaged and stored as digital values.
- If time average is set, analog input data items acquired will be stored in unit memory (UM) as digital values when the acquisition period of the analog input data items reaches the set averaging time.
- Obtain the time average to be processed from the following input.

Input	The sum of analog input data items for the number of averaging time.
Output	Time average value

■ Processing during time average

Average setting example: Example of an averaging time of 200 msec



■ Configuration

Name		Default	Setting range and description
Function setting	Average processing	Not execute	Select "time average".
	Averaging constant	K200	Time: 200 to 60000 [ms] (specified with an unsigned integer)

6.1.3 Moving Average

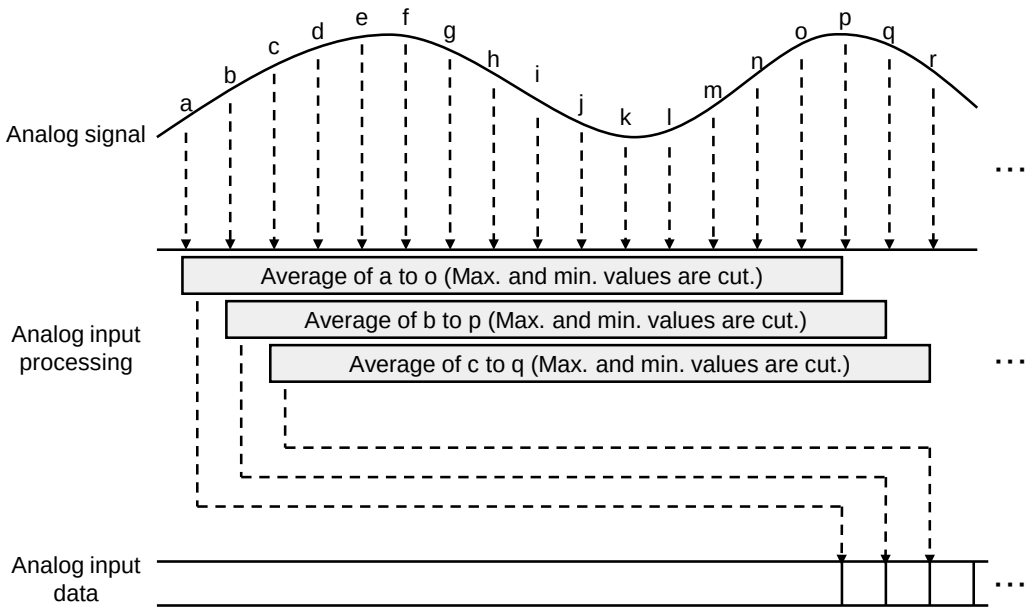
■ **Overview of functions**

- Analog input data sampled by the unit is averaged and stored as digital values.
- If moving average is set, analog input data items acquired will be stored in unit memory (UM) as digital values when the number of analog input data items reaches the set number of moving average times.
- When the set number of moving average times is 3 to 64, the maximum and minimum values are cut from the data for n times, and the data for (n-2) times is averaged.
- When the set number of moving average times is 1 or 2, the latest measured data is stored without averaging processing.
- When data sampling for the set number of times has not been completed, data is not updated. When all data are acquired, the data will be updated.
- Obtain output (moving average value) to be processed from the following input.

Input	The number of average times, analog input data for the number of average times, the latet analog input data, and old analog input data
Output	Moving average value

■ **Processing during moving average**

Averaging setting example: The number of averaging times is set to 15.



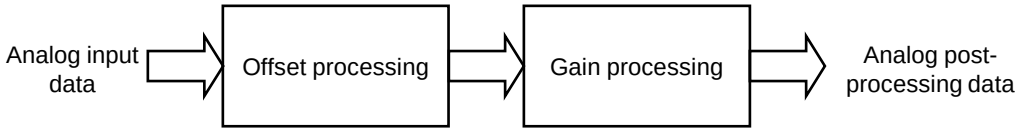
■ **Configuration**

Name		Default	Setting range and description
Function setting	Average processing	Not execute	Select "moving average".
	Averaging constant	K8	Number: 3 to 64 [times] (specified with an unsigned integer)

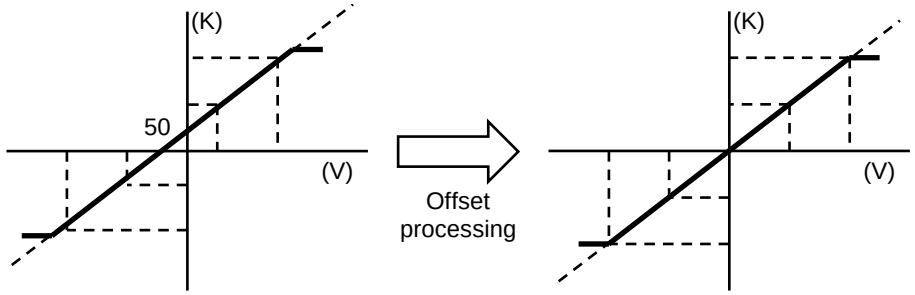
6.2 Offset/Gain Processing

■ **Overview of functions**

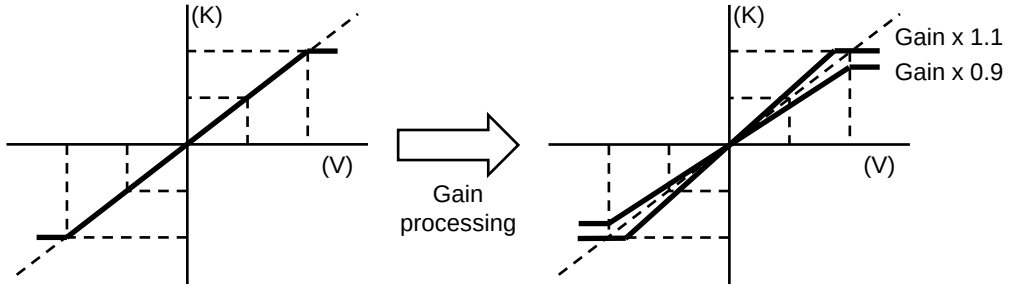
- Offset value (added correction) and gain value (magnification correction) adjustments are made to store processed data in the I/O area.



- Offset value settings are used as a function (zero-point adjustment) to make offset error adjustments between load devices. If the analog conversion value is K50 when the analog input value is 0 V, the analog conversion data is corrected to 0 V based on K-50 as an offset value.



- Gain value settings are used as a function to adjust delicate scale errors between load devices. The gain value slope can be changed in a range of x0.9 to x1.1.



- Offset/Gain processing is executed on a channel-by-channel basis.

■ **Configuration**

Name		Default	Setting range and description
Function setting	Offset/Gain Processing	Not execute	Select "Execute".
Offset value		K0	Set an offset value at the time of using the offset processing function. Setting range: -3000 to +3000 (specicfied with a signed integer)
Gain value		K10000	Set an offset value at the time of using the offset processing function. Setting range: +9000 to +11000 (0.9x to 1.1x: Specified with a signed integer)

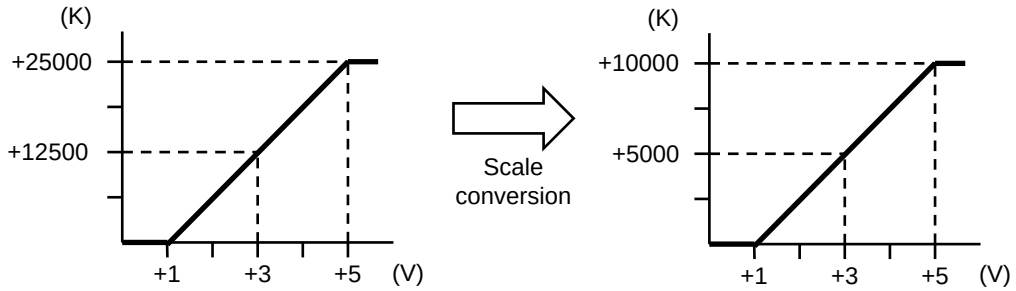
◆ **KEY POINTS**

- **The offset value is corrected to a value corresponding to the resolution of the input range of the original value regardless of whether scale conversion is set or not.**

6.3 Scale Conversion (AFP7TC8 Voltage/Current Range Only)

■ Overview of functions

- This function makes it possible to convert values to an easy-to-use data range. Analog input data acquired in a range between preset minimum and maximum values is scale converted and stored in the I/O area. This function is convenient if used for scale unit conversion.
- Scale conversion is executed on a channel-by-channel basis.
- Conversion values read from the analog input unit include fractions. Therefore, convert the values to easy-to-handle figures if needed.



■ Configuration

Name		Default	Setting range and description
Function setting	Scale conversion	Not execute	Select "Execute".
Minimum value of scale conversion		K0	Set the minimum value at the time of using the scale conversion function. Setting range: -3000 to +30000 (specicfied with a signed integer)
Maximum value of scale conversion		K10000	Set the maximum value at the time of using the scale conversion function. Setting range: -3000 to +30000 (specicfied with a signed integer)

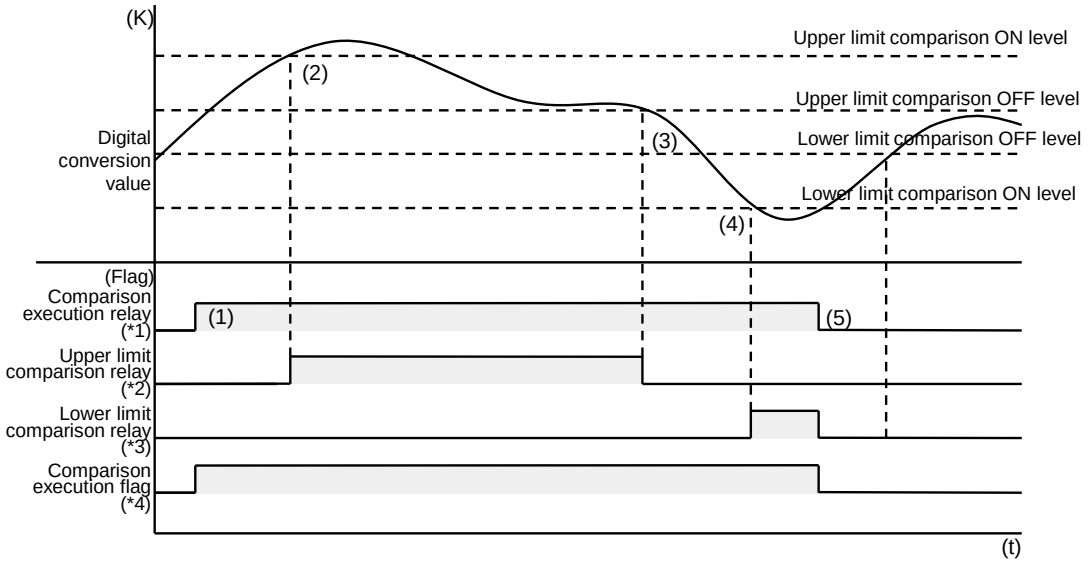
(Note 1) If data outside the minimum or maximum scale is input, scale conversion will be disabled and the minimum or maximum scale value will be stored as a conversion value.

6.4 Comparison for Upper and Lower Limits

■ **Overview of functions**

This function compares acquired data with the upper limit and lower limit and turns ON the upper limit relay or lower limit relay if the acquired data exceeds the upper limit value or lower limit value.

- Comparison for upper and lower limits is executed on a channel-by-channel basis.
- The upper limit relay will turn ON if the digital conversion value is larger than the upper limit.
- The lower limit relay will turn ON if the digital conversion value is smaller than the lower limit.
- The function will be disabled with the comparison execution relay (Y) turned ON if the configuration-upper/lower limit comparison setting is not executed.



(1) The upper/lower limit comparison function will be executed when the user program turns ON the comparison execution relay.

(2) The upper limit comparison relay will turn ON if the upper limit comparison ON level or an upper level is detected.

(3) The upper limit comparison relay will turn OFF if the upper limit comparison OFF level or a lower level is detected.

(4) The lower limit comparison relay will turn ON if the lower limit comparison ON level or a lower level is detected.

(5) The upper/lower limit comparison relay and comparison execution flag will be forcibly turned OFF if the comparison execution relay is turned OFF.

■ I/O allocation

The I/O numbers in the timing chart and program are shown on the condition that the starting word number of the unit is 10. Actual I/O numbers allocated to the analog input unit are determined by the starting word number.

	CH0	CH1	CH2	CH3	CH4	CH5	CH6	CH7
*1 Comparison execution relay	Y103	Y113	Y123	Y133	Y143	Y153	Y163	Y173
*2 Upper limit comparison relay	X111	X131	X151	X171	X191	X211	X231	X251
*3 Lower limit comparison relay	X112	X132	X152	X172	X192	X212	X232	X252
*4 Comparison execution flag	X113	X133	X153	X173	X193	X213	X233	X253

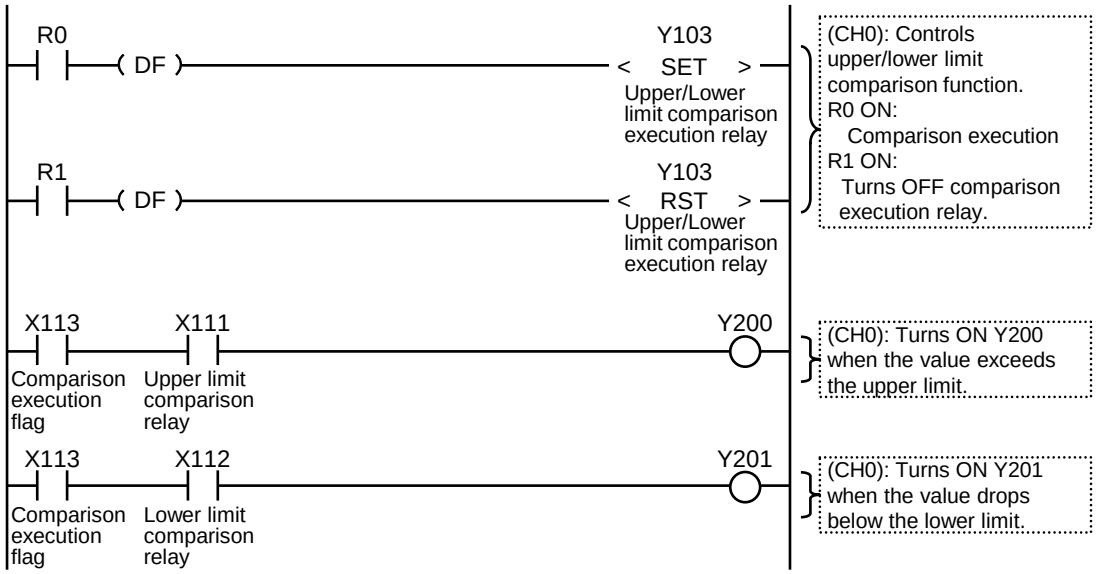
■ Configuration

Name		Default	Setting range and description
Function setting	Upper/Lower limit comparison	Not execute	Select the desired function to be used.
Upper/Lower limit comparison Upper limit comparison ON level		K1000	Set the upper limit to turn ON the output flag at the time of using the upper/lower limit comparison function. Setting range: -31250 to +31250 (specicfied with a signed integer)
Upper/Lower limit comparison Upper limit comparison OFF level		K1000	Set the upper limit to turn OFF the output flag at the time of using the upper/lower limit comparison function. Setting range: -31250 to +31250 (specicfied with a signed integer)
Upper/Lower limit comparison Lower limit comparison OFF level		K0	Set the lower limit to turn OFF the output flag at the time of using the upper/lower limit comparison function. Setting range: -31250 to +31250 (specicfied with a signed integer)
Upper/Lower limit comparison Lower limit comparison ON level		K0	Set the lower limit to turn ON the output flag at the time of using the upper/lower limit comparison function. Setting range: -31250 to +31250 (specicfied with a signed integer)

(Note 1) Make the following level settings for upper/lower limit comparison.
Lower limit comparison ON level ≤ Lower limit comparison OFF level < Upper limit comparison OFF level ≤ Upper limit comparison ON level

■ **Sample program**

The digital conversion value on ch0 of the unit is read to detect the upper limit and lower limit, and the desired output is turned ON with the upper or lower limit detected.

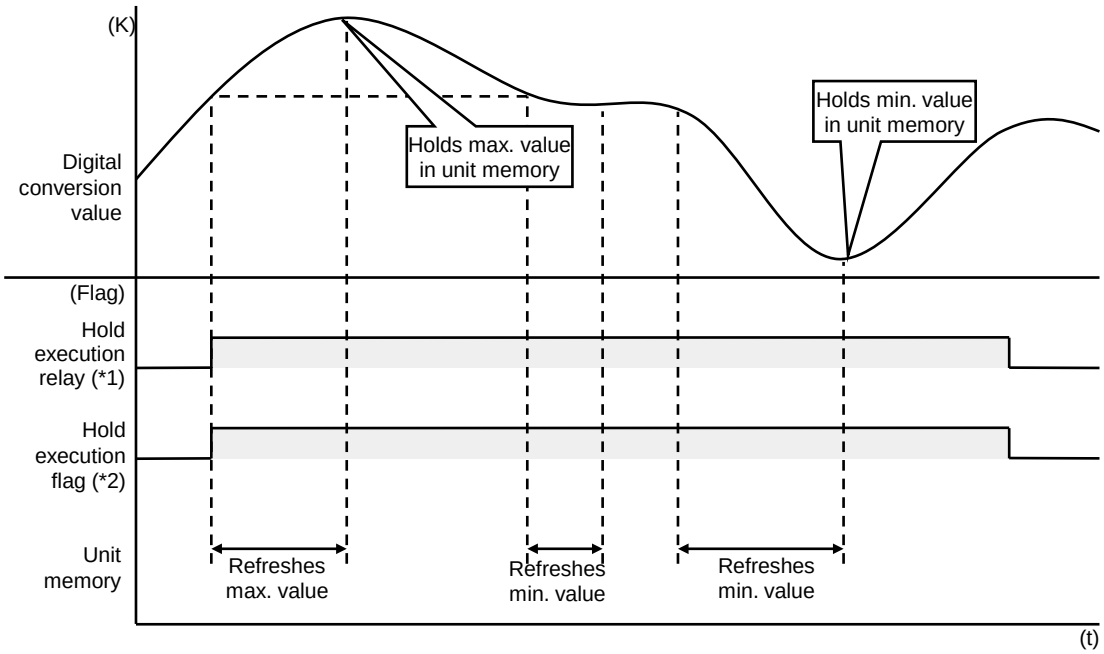


6.5 Holding Maximum and Minimum Values

■ **Overview of functions**

This function maintains the maximum and minimum values of acquired data. Holds the maximum and minimum digital conversion values when the maximum/minimum value hold setting is enabled, and stores the values in provided unit memories for each channel.

- If the function has not been enabled with the configuration settings, the function will not work with the hold execution relay turned ON.
- When the hold execution relay is turned ON, the values at the time will be preset as maximum and minimum values in the unit memories.
- The maximum and minimum values will be stored in the unit memories even if the hold execution relay is turned OFF or the unit is set into PROG. mode.
- The maximum and minimum values are held on a channel-by-channel basis.



■ **Hold data storage area**

Unit memory No.(Hex)	Name	Default	Data range and description
UM 00170 UM 00171 UM 00172 UM 00173 UM 00174 UM 00175 UM 00176 UM 00177	Holding max. value	K0	The acquired maximum value will be held when the maximum and minimum value hold function is used. Setting range: -31250 to +31250 (specified with a signed integer)
UM 00178 UM 00179 UM 0017A UM 0017B UM 0017C UM 0017D UM 0017E UM 0017F	Holding min. value	K0	The acquired maximum value will be held when the maximum and minimum value hold function is used. Setting range: -31250 to +31250 (specified with a signed integer)

(Note) The unit memory numbers in the above table are listed for CH0 to CH7 in numerical order.

■ **I/O allocation**

The I/O numbers in the timing chart and program are shown on the condition that the starting word number of the unit is 10. Actual I/O numbers allocated to the analog input unit are determined by the starting word number.

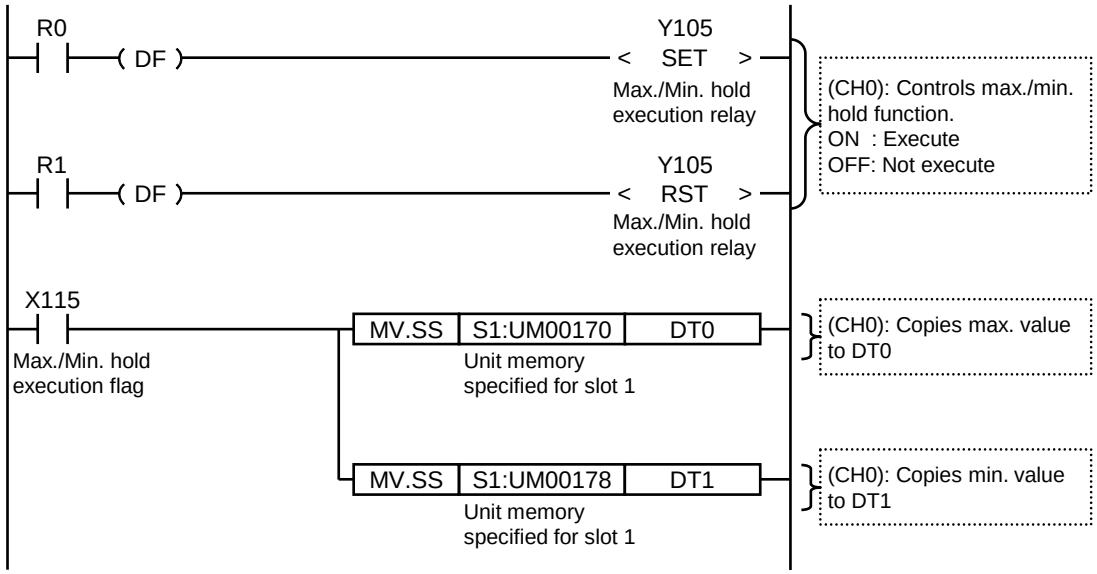
	CH0	CH1	CH2	CH3	CH4	CH5	CH6	CH7
*1 Hold execution relay	Y105	Y115	Y125	Y135	Y145	Y155	Y165	Y175
*2 Hold execution flag	X115	X135	X155	X175	X195	X215	X235	X255

■ **Configuration**

Name		Default	Setting range and description
Function setting	Holding max./min. values	Not execute	Select "Execute".
Holding min. value		K0	Holding min. value (-31250 to +31250)
Holding max. value		K0	Holding max. valeu (-31250 to +31250)

■ **Sample program**

The analog data on ch0 of the unit is read, and the data holding the maximum and minimum values will be read at the desired data register.



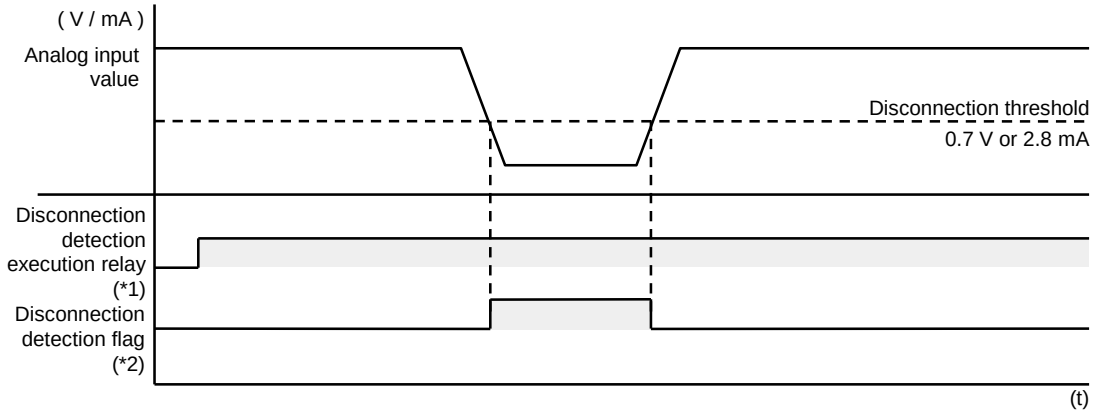
6.6 Disconnection Detection (AFP7TC8)

■ Overview of functions

This function is to announce an error with the disconnection detection flag if the result of input does not reach a certain value while thermocouple input, voltage input range of +1 to +5 V or current input range of +4 to +20 mA is set in the thermocouple multi-analog input unit.

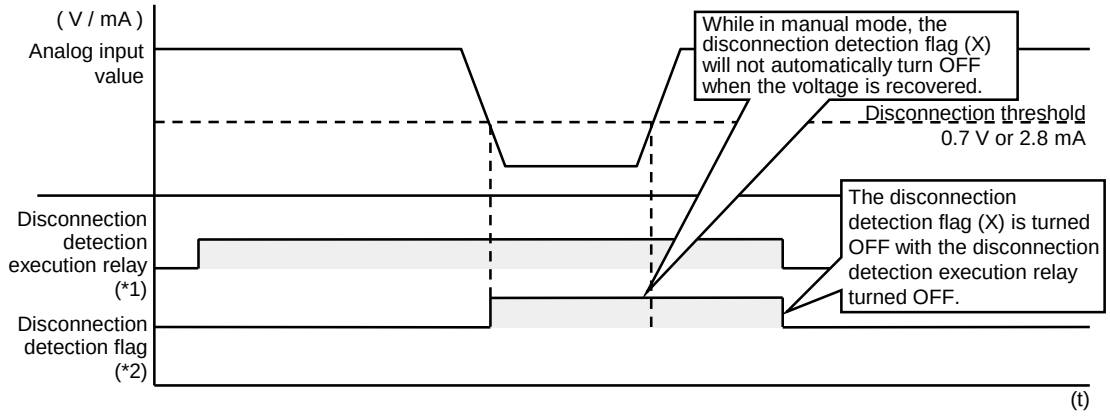
- If disconnection is detected while the disconnection detection execution relay is ON using a user program, the disconnection detection flag will be turned ON.
- There are two ways to reset the disconnection detection. When selecting "Auto", the disconnection detect flag will be automatically turned OFF at the time of reset. If the manual reset setting is made, the disconnection detection flag will be turned OFF by using a user program and turning OFF the disconnection detection execution relay.

■ Action with the detection disconnection reset setting set to auto



(Note) The disconnection threshold in the above figure is that when the voltage input range of +1 to +5 V or current input range of +4 to +20 mA is set.

■ Action with the detection disconnection reset setting set to manual


(V / mA)
Analog input value
While in manual mode, the disconnection detection flag (X) will not automatically turn OFF when the voltage is recovered.
Disconnection threshold
0.7 V or 2.8 mA
The disconnection detection flag (X) is turned OFF with the disconnection detection execution relay turned OFF.
Disconnection detection execution relay (*1)
Disconnection detection flag (*2)
(t)

(Note) The disconnection threshold in the above figure is that when the voltage input range of +1 to +5 V or current input range of +4 to +20 mA is set.

■ I/O allocation

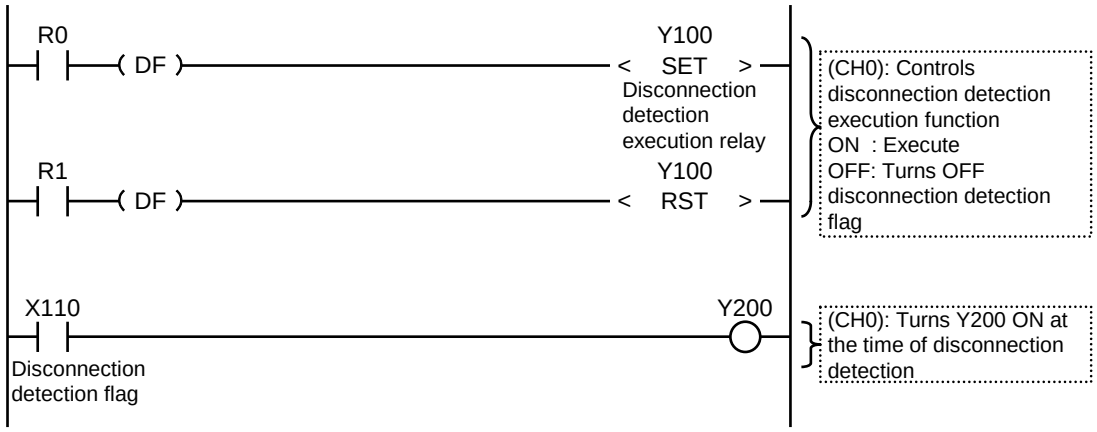
The I/O numbers in the timing chart and program are shown on the condition that the starting word number of the unit is 10. Actual I/O numbers allocated to the analog input unit are determined by the starting word number.

	CH0	CH1	CH2	CH3	CH4	CH5	CH6	CH7
*1 Disconnection detection execution relay	Y100	Y110	Y120	Y130	Y140	Y150	Y160	Y170
*2 Disconnection detection flag	X110	X130	X150	X170	X190	X210	X230	X250

■ Configuration

Name		Default	Setting range and description
Function setting	Disconnection detection	Not execute	Select "Execute".
	Disconnection detection reset	Auto	Select "Auto".

■ Sample program



◆ KEY POINTS

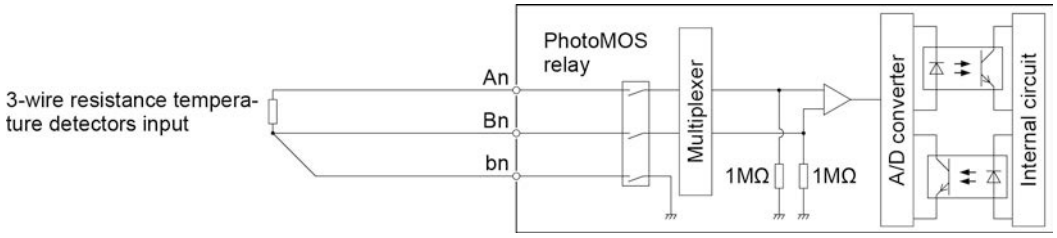
- **Not executed unless thermocouple, a voltage input range of +1 to +5 V or current input range of +4 to +20 mA is set. This function will not be executed even if the disconnection detection execution relay is turned ON when the disconnection detection has been set to "Not execute" in the configuration.**

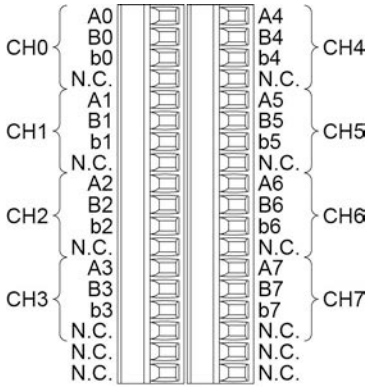
6.7 Disconnection Detection (AFP7RTD8)

■ **Overview of functions**

This function is to warn of the error state by converting to a digital value in the range (K30000) which is different from the values converted in the normal state when the disconnection is detected in the RTD input unit.

- In the figure below, it is regarded as disconnection when the line of the A terminal is disconnected or the lines of the B terminal and b terminal are both disconnected. If either line of the B terminal or b terminal is connected, it is not detected as disconnection.





◆ **KEY POINTS**

- **On the RTD input unit (AFP7RTD8), the disconnection detection execution relay and the disconnection detection flag cannot be used.**

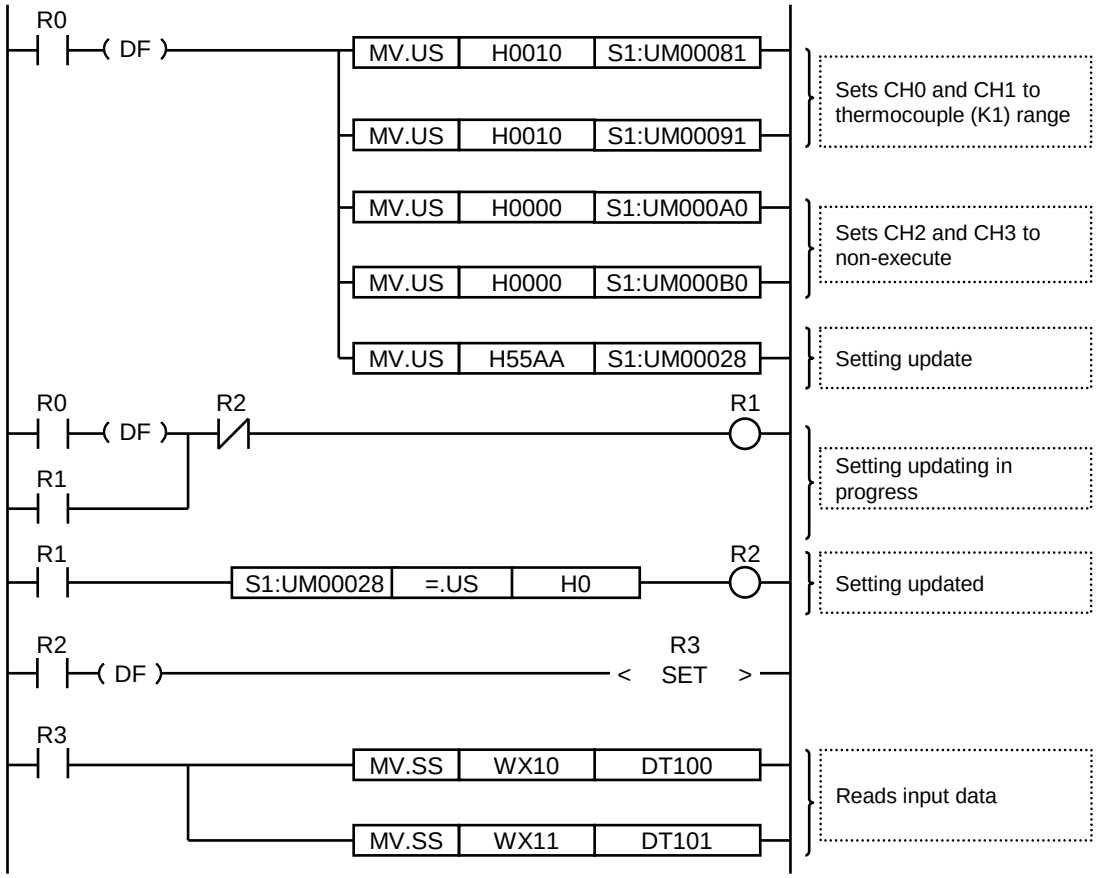
6.8 Configuration by Programming

■ **Overview of functions**

- The thermocouple multi-analog input unit and the RTD input unit make it possible to overwrite configuration information by programming.
- The configuration information is refreshed by writing "55AA" to unit memory UM 00028 after the value is stored in the unit memory where a desired parameter is set.
- The value of unit memory UM 00028 will be set to 0 when the configuration information is refreshed.

■ **Sample program**

Program setting the input range of CH0/CH1 to the thermocouple input K1 range (-100 to 600 °C) and CH2 and CH3 as non-execution channel for the thermocouple multi-analog input unit in the slot number 1



7

What to Do If an Error Occurs

7.1 What to Do If an Error Occurs (Analog Input)

7.1.1 Failure in Reading Input Data

- Check again that I/O allocations are correct.
- Check again the connection of the terminal block.
- Check again the configuration settings.

7.1.2 Unstable Input Conversion Value

- Check that the power frequency setting (unit memory UM 00072) complies with the frequency in the region where the unit is used.
- Check that a twisted pair shielded wire is used and the wire is properly shielded.
- Check that the input wiring is not placed close to AC lines or high-tension lines or bundled with the lines.
- Check that there are not power lines, high-tension lines, high-capacity relays, or noise-generating equipment, such as inverters, close to the unit.

7.1.3 No Proper Conversion Values Obtained with Current Input

- Check again the connection of the terminal block.
- Check again the connections of the output equipment.

8

Specifications

8.1 Specifications

8.1.1 General Specifications

Item	Specifications	
Operating ambient temperature	0 °C to +55 °C	
Storage ambient temperature	-40 °C to +70 °C	
Operating ambient humidity	10 to 95%RH (at 25 °C, no condensation)	
Storage ambient humidity	10 to 95%RH (at 25 °C, no condensation)	
Breakdown voltage (Note)	Between I/O terminals and CPU power supply terminal/function earth	500 V AC for 1 minute
	Between analog input terminal channels	200 V AC for 1 minute
Insulation resistance	Between I/O terminals and CPU power supply terminal/function earth	100 MΩ (Test voltage: 500 V DC)
Vibration resistance	Conforms to JISB3502 and IEC61131-2. 5 to 8.4 Hz, 3.5-mm single amplitude 8.4 to 150 Hz, Acceleration 9.8 m/s^2 10 sweeps each in X, Y and Z directions (1 octave/min)	
Shock resistance	Conforms to JISB3502 and IEC61131-2. 147 m/s^2, 3 times in the X, Y, Z directions	
Noise resistance	1,000 V DC [P-P] with pulse width of 50 ns or 1 μs (by using a noise simulator) (Applied to the power supply of the CPU unit)	
Environment	Free from corrosive gases and excessive dust	
EU Directive applicable standard	EMC Directive: EN61131-2	
Overvoltage category	Category II	
Pollution degree	Pollution level 2	

(Note) Cutoff current: 5 mA (Factory default setting)

8.1.2 Specifications of Thermocouple Multi-analog Input Unit (AFP7TC8)

■ **Performance specifications**

Item		**Specifications**
Number of channels		8 channels
Input range (resolution)	Voltage	-10 to 10 V DC (Resolution: 1/62,500) 0 to 5 V DC (Resolution: 1/31,250) 1 to 5 V DC (Resolution: 1/25,000) (Note 1) -100 to 100 mV DC (Resolution: 1/62,500)
	Current	0 to 20 mA (Resolution: 1/31,250) 4 to 20 mA (Resolution: 1/25,000) (Note 1)
	Thermocouple (resolution: 0.1 °C)	K1: -100.0 to 600.0 °C / K2: -200.0 to 1000.0 °C
		J1: -100.0 to 400.0 °C / J2: -200.0 to 750.0 °C
		T: -270.0 to 400.0 °C
		N: -270.0 to 1300.0 °C
		R: 0.0 to 1760.0 °C
		S: 0.0 to 1760.0 °C
		B: 0.0 to 1820.0 °C
		E: -270.0 to 1000.0 °C
		PL Ⅱ: 0.0 to 1390.0 °C
		WRe5-26: 0.0 to 2315.0 °C
Conversion speed		Processing time is added to the conversion time for the number of execution channels. High-speed mode: 5 ms/ch + 5 ms (Note 2) Normal mode: 25 ms/ch + 25 ms
Indication accuracy (Note 4)		±0.1% F.S. or less (at 25 °C in the normal mode)(Note 3) ±0.3% F.S. or less (at 0 to +55 °C)
Reference junction compensation accuracy		±1.0 °C (with thermocouple input)
Input impedance	Voltage input	1 MΩ
	Current input	250 Ω
Absolute max. input		-15 to 15 V DC Voltage input -2 to 30 mA Current input
Insulation method	Between input terminals and internal circuit	Photocoupler Insulated DC/DC converter
	Between channels	PhotoMOS relay
Execution/Non-execution channel settings		Possible to make settings on a channel-by-channel basis.
Input range selection		Possible to make settings on a channel-by-channel basis.

Item		Specifications
Digital processing	Average processing settings	Number of averaging times, Time average, Moving average
	Scale conversion setting	A desired value within the range of ±30,000 (Voltage/current range only)
	Offset setting	A desired value within the range of ±3,000
	Gain setting	±10%
Upper/Lower limit comparison		Possible to make settings on a channel-by-channel basis.
Holding max./min. values		Possible to make settings on a channel-by-channel basis.
Disconnection detection		Available (Voltage range of 1 to 5 V, current range of 4 to 20 mA and thermocouple range only)
External connection method		Connection terminal block connection
Weight (main unit)		145 g
Consumption current		80 mA or less

(Note 1) The full scale (F.S.) on the accuracy of a voltage range from 1 to 5 V DC and that of a current range from 4 to 20 mA are 0 to 5 V DC and 0 to 20 mA, respectively.

(Note 2) The indication accuracy in the high-speed mode is ±0.3% (at 0 to 55 °C).

(Note 3) The indication accuracy rating of the thermocouple range varies by the input type of the thermocouple to be used and measurement temperature.

(Note 4) If highly accurate temperature data is necessary, use the temperautre data in about 30 minutes after the unit was powered on.

(Note 5) If a sudden temperature change occurs in the unit, the accuracy may not be stable temporarily. Install to keep the unit out of the direct wind from devices such as a cooling fan in a control panel.

◆ **REFERENCE**

- **Also refer to the section "Indication accuracy rating of thermocouple range" on the next page.**

■ Indication accuracy rating of thermocouple range

Thermocouple	Measurement temperature range (Note 1)	Normal mode: 25-ms conversion		High-speed mode: 5-ms conversion
		Ambient temperature 25 °C	Ambient temperature 0 to 55 °C	Ambient temperature 0 to 55 °C
K1	-100.0 to 600.0 °C	0.1%	±0.3%	±0.30%
K2	-200.0 to 1000.0 °C	±0.1%	±0.3%	±0.30%
J1	-100.0 to 400.0 °C	±0.1%	±0.3%	±0.30%
J2	-200.0 to 750.0 °C	±0.1%	±0.3%	±0.30%
T	-270.0 to -200.0 °C	(Note 2)	(Note 2)	(Note 2)
	-200.0 to 0.0 °C	±0.15%	±0.3%	±0.30%
	0.0 to 400.0 °C	±0.1%	±0.3%	±0.30%
N	-270.0 to -200.0 °C	(Note 2)	(Note 2)	(Note 2)
	-200.0 to 0.0 °C	±0.15%	±0.3%	±0.30%
	0.0 to 1300.0 °C	±0.1%	±0.3%	±0.30%
R	0.0 to 300.0 °C	±0.15%	±0.3%	±1.00%
	300.0 to 1760.0 °C	±0.1%	±0.3%	±0.30%
S	0.0 to 300.0 °C	±0.15%	±0.3%	±1.00%
	300.0 to 1760.0 °C	±0.1%	±0.3%	±0.30%
B	0.0 to 400.0 °C	(Note 2)	(Note 2)	(Note 2)
	400.0 to 800.0 °C	±0.15%	±0.3%	±1.00%
	800.0 to 1820.0 °C	±0.1%	±0.3%	±0.30%
E	-270.0 to -200.0 °C	(Note 2)	(Note 2)	(Note 2)
	200.0 to 0.0 °C	±0.15%	±0.3%	±1.00%
	0.0 to 1000.0 °C	±0.1%	±0.3%	±0.30%
PLII	0.0 to 1390.0 °C	±0.1%	±0.3%	±0.30%
WRe5-26	0.0 to 2315.0 °C	±0.1%	±0.3%	±0.30%

(Note 1) Although it is possible to measure the temperature of ±15 °C outside the measurement temperature range, the accuracy cannot be assured.

(Note 2) Although it is possible to measure temperatures, the accuracy cannot be assured.

8.1.3 Specifications of RTD Unit (AFP7RTD8)

Item		Specifications
Number of channels		8 channels
Input range (resolution)	RTD (resolution: 0.1 °C)	Pt100 (1): -100.0 to 200.0 ℃
		Pt100 (2): -200.0 to 650.0 °C
		JPt100 (1): -100.0 to 200.0 °C
		JPt100(2): -200.0 to 650.0 °C
		Pt1000: -100.0 to 100.0 °C
Conversion speed		Processing time is added to the conversion time for the number of execution channels. 25 ms/ch + 25 ms
Total accuracy		±0.1%F.S. or less (at 25 °C) ±0.3%F.S. or less (at 0 to +55 °C)
Allowable signal source resistance		RTD input: 30 Ω (3-wire balance)
Insulation method	Between input terminals and internal circuit	Photocoupler Insulated DC/DC converter
	Between channels	PhotoMOS relay
Execution/Non-execution channel settings		Possible to make settings on a channel-by-channel basis.
Input range selection		Possible to make settings on a channel-by-channel basis.
Digital processing	Average processing	Number of averaging times, Time average, Moving average
	Offset setting	A desired value within the range of ±3,000
	Gain setting	±10%
Upper/Lower limit comparison		Possible to make settings on a channel-by-channel basis.
Holding max./min. values		Possible to make settings on a channel-by-channel basis.
Disconnection detection		Available
External connection method		Connection terminal block connection
Weight (main unit)		145 g
Consumption current		65 mA or less

(Note) If highly accurate temperature data is necessary, use the temperature data in about 30 minutes after the unit was powered on.

8.2 I/O Allocation

■ **Input contact**

I/O area number	Name	Default	Description
WX0	CH0 Analog conversion data	K0	Analog conversion data area Digital conversion values corresponding to analog input are stored as 16-bit signed integer data. Stored values vary by ranges. When optional average processing, scale conversion, offset/gain processing has been set, data after the processing is stored. Optional function flag area Refer to the next page.
WX1	CH0 Optional function flag	H0	
WX2	CH1 Analog conversion data	K0	
WX3	CH1 Optional function flag	H0	
WX4	CH2 Analog conversion data	K0	
WX5	CH2 Optional function flag	H0	
WX6	CH3 Analog conversion data	K0	
WX7	CH3 Optional function flag	H0	
WX8	CH4 Analog conversion data	K0	
WX9	CH4 Optional function flag	H0	
WX10	CH5 Analog conversion data	K0	
WX11	CH5 Optional function flag	H0	
WX12	CH6 Analog conversion data	K0	
WX13	CH6 Optional function flag	H0	
WX14	CH7 Analog conversion data	K0	
WX15	CH7 Optional function flag	H0	

(Note 1): The I/O numbers in the table indicates offset addresses. The I/O numbers actually allocated are the numbers based on the starting word number allocated to the unit. Example) When the starting word number for the unit is "10", the A/D conversion data of CH0 is WX10 and the error flag is X11F.

■ Input contact (Optional functions/Error flag area)

I/O number								Name	Description
CH0	CH1	CH2	CH3	CH4	CH5	CH6	CH7		
X10	X30	X50	X70	X90	X110	X130	X150	Disconnection detection flag	ON with disconnection detected and OFF with disconnection restored. (Valid for thermocouple, voltage:1-5 V and current: 4-20 mA ranges only)
X11	X31	X51	X71	X91	X111	X131	X151	Upper limit comparison relay	Turns ON when the value exceeds the set upper limit.
X12	X32	X52	X72	X92	X112	X132	X152	Lower limit comparison relay	Turns OFF when the value drops below the set lower limit.
X13	X33	X53	X73	X93	X113	X133	X153	Upper/Lower limit comparison execution flag	Turns ON when the upper limit/lower limit comparison function is executed.
X14	X34	X54	X74	X99	X114	X134	X154	Not used	Do not use.
X15	X35	X55	X75	X95	X115	X135	X155	Max./Min. hold execution flag	Turns ON when the max./min. hold function is executed.
X16 to X1E	X36 to X3E	X56 to X5E	X76 to X7E	X96 to X9E	X116 to X11E	X136 to X13E	X156 to X15E	Not used	Do not use.
X1F	X3F	X5F	X7F	X9F	X11F	X13F	X15F	Error flag	Turns ON when an error occurs

(Note 1): The I/O numbers in the table indicates offset addresses. The I/O numbers actually allocated are the numbers based on the starting word number allocated to the unit. Example) When the starting word number for the unit is "10", the C error flag is X11F.

■ Output contact

I/O number								Name	Description
CH0	CH1	CH2	CH3	CH4	CH5	CH6	CH7		
Y0	Y10	Y20	Y30	Y40	Y50	Y60	Y70	Disconnection detection execution relay	ON to execute the disconnection detection function. OFF to turn OFF the disconnection detection flag (Xn0). (Valid for thermocouple, voltage:1-5 V and current: 4-20 mA ranges only)
Y1	Y11	Y21	Y31	Y41	Y51	Y61	Y71	Not used	Do not use.
Y2	Y12	Y22	Y32	Y42	Y52	Y62	Y72		
Y3	Y13	Y23	Y33	Y43	Y53	Y63	Y73	Upper/Lower limit comparison execution relay	ON to execute the function to compare the upper and lower limits. OFF to turn OFF the upper limit comparison relay (Xn1) and lower limit comparison relay (Xn2).
Y4	Y14	Y24	Y34	Y44	Y54	Y64	Y74	Not used	Do not use.
Y5	Y15	Y25	Y35	Y45	Y55	Y65	Y75	Max./Min. hold execution relay	ON to execute the max./min. hold function.
Y6 to YE	Y16 to Y1E	Y26 to Y2E	Y36 to Y3E	Y46 to Y4E	Y56 to Y5E	Y66 to Y6E	Y76 to Y7E	Not used	Do not use.
YF	Y1F	Y2F	Y3F	Y4F	Y5F	Y6F	Y7F	Error flag reset relay	Resets an error flag.

(Note 1): The I/O numbers in the table indicates offset addresses. The I/O numbers actually allocated are the numbers based on the starting word number allocated to the unit. Example) When the starting word number for the unit is "10", the disconnection detection execution relay of CH0 is Y100, and the error flag reset relay is Y10F.

8.3 List of Unit Memories

8.3.1 Configuration Area

User programs are not necessary, because the configuration area will be written automatically if it is set with the tool software. In the case of changing settings with user programs, specify the desired unit memory number and write the corresponding values.

■ **Setting monitoring items and allocation of unit memories (CH0 to CH3)**

Setting monitoring item		Unit memory (UM) number			
		CH0	CH1	CH2	CH3
Configuration settings refresh		UM 00028			
Power frequency setting		UM 00071			
Conversion time setting		UM 00072			
Conversion processing		UM 00080	UM 00090	UM 000A0	UM 000B0
Range setting		UM 00081	UM 00091	UM 000A1	UM 000B1
Function setting 1	Average processing Offset/Gain processing Scale conversion	UM 00082	UM 00092	UM 000A2	UM 000B2
Function setting 2	Upper/Lower limit comparison Holding max./min. values Disconnection detection, Disconnection detection reset	UM 00083	UM 00093	UM 000A3	UM 000B3
Averaging constant		UM 00084	UM 00094	UM 000A4	UM 000B4
Offset value		UM 00085	UM 00095	UM 000A5	UM 000B5
Gain value		UM 00086	UM 00096	UM 000A6	UM 000B6
Scale conversion	Max. value	UM 00087	UM 00097	UM 000A7	UM 000B7
	Min. value	UM 00088	UM 00098	UM 000A8	UM 000B8
Upper/Lower limit comparison	Upper limit comparison ON level	UM 00089	UM 00099	UM 000A9	UM 000B9
	Upper limit comparison OFF level	UM 0008A	UM 0009A	UM 000AA	UM 000BA
	Lower limit comparison OFF level	UM 0008B	UM 0009B	UM 000AB	UM 000BB
	Lower limit comparison ON level	UM 0008C	UM 0009C	UM 000AC	UM 000BC
Max./Min. value hold monitor area	Holding max. value	UM 00170	UM 00171	UM 00172	UM 00173
	Holding min. value	UM 00178	UM 00179	UM 0017A	UM 0017B

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■ Setting monitoring items and allocation of unit memories (CH4 to CH7)

Setting monitoring item		Unit memory (UM) number			
		CH4	CH5	CH6	CH7
Configuration settings refresh		UM 00028			
Power frequency setting		UM 00071			
Conversion time setting		UM 00072			
Conversion processing		UM 000C0	UM 000D0	UM 000E0	UM 000F0
Range setting		UM 000C1	UM 000D1	UM 000E1	UM 000F1
Function setting 1	Average processing Offset/Gain processing Scale conversion	UM 000C2	UM 000D2	UM 000E2	UM 000F2
Function setting 2	Upper/Lower limit comparison Holding max./min. values Disconnection detection Disconnection detection reset	UM 000C3	UM 000D3	UM 000E3	UM 000F3
Averaging constant		UM 000C4	UM 000D4	UM 000E4	UM 000F4
Offset value		UM 000C5	UM 000D5	UM 000E5	UM 000F5
Gain value		UM 000C6	UM 000D6	UM 000E6	UM 000F6
Scale conversion	Max. value	UM 000C7	UM 000D7	UM 000E7	UM 000F7
	Min. value	UM 000C8	UM 000D8	UM 000E8	UM 000F8
Upper/Lower limit comparison	Upper limit comparison ON level	UM 000C9	UM 000D9	UM 000E9	UM 000F9
	Upper limit comparison OFF level	UM 000CA	UM 000DA	UM 000EA	UM 000FA
	Lower limit comparison OFF level	UM 000CB	UM 000DB	UM 000EB	UM 000FB
	Lower limit comparison ON level	UM 000CC	UM 000DC	UM 000EC	UM 000FC
Max./Min. value hold monitor area	Holding max. value	UM 00174	UM 00175	UM 00176	UM 00177
	Holding min. value	UM 0017C	UM 0017D	UM 0017E	UM 0017F

◆ NOTES

- **Unit memories (UM) include the areas used in the system. Do not write data with user programs in the areas other than the configuration area where the settings are opened.**

Unit memory (UM) No. range	Application
UM00000 to UM0006F (UM 00028 can be set.)	Reserved area for the system
UM00070 to UM000FF	Configuration area
UM00100 to UM0016F	Reserved area for the system
UM00170 to UM001FF	Monitor area
UM00200 to UM0FFFF	Reserved area for the system

8.4 List of Detailed Specifications of Unit Memories

■ Common to all channels

Unit memory No. (Hex)	Name	Default	Setting range and description
UM 00028	Unit memory refresh	H0	This is used to rewrite configuration infromation using a user program. If the constant "55AA" is written to the unit memory UM 00028 after transferring a desired parameter to a unit memory, the settings will be updated. The value of unit memory UM 00028 will be set to 0 when the configuration information is refreshed.
UM 00071	Power frequency	H0	Select a power frequency. H0: 60 Hz H1: 50 Hz
UM 00072	Conversion time	H0	For the thermocouple multi-analog input unit, select a conversion time per channel. H0: 25 ms H1: 5 ms

■ **Individual setting area per channel**

Unit memory No. (Hex)	Name	Default	Setting range and description	
UM 00080 UM 00090 UM 000A0 UM 000B0 UM 000C0 UM 000D0 UM 000E0 UM 000F0	Conversion processing Execution/Non-execution	H1	Select wheter to execute the conversion processing or not. H0: Not execute H1: Execute	
UM 00081 UM 00091 UM 000A1 UM 000B1 UM 000C1 UM 000D1 UM 000E1 UM 000F1	Range setting For Thermocouple multi-analog input unit	H1	Select the input range.	
			0001h	Voltage input -10 V to +10 V
			0002h	Voltage input 0 V to +5 V
			0003h	Voltage input 1 V to +5 V
			0004h	Voltage input -100 mV to +100 mV
			0005h	Current input 0 mA to +20 mA
			0006h	Current input +4 mA to +20 mA
			0010h	Thermocouple input K1 (-100.0 to 600.0 °C)
			0011h	Thermocouple input K2 (-200.0 to 1000.0 °C)
			0012h	Thermocouple input J1 (-100.0 to 400.0 °C)
			0013h	Thermocouple input J2 (-200.0 to 750.0 °C)
			0014h	Thermocouple input T (-270.0 to 400.0 °C)
			0015h	Thermocouple input N (-270.0 to 1300.0 °C)
			0016h	Thermocouple input R (0.0 to 1760.0 °C)
			0017h	Thermocouple input S (0.0 to 1760.0 °C)
			0018h	Thermocouple input B (0.0 to 1820.0 °C)
			0019h	Thermocouple input E (-270.0 to 1000.0 °C)
			001Ah	Thermocouple input PLⅡ (0.0 to 1390.0 °C)
			001Bh	Thermocouple input WRe5-26 (0.0 to 2315.0 °C)
UM 00081 UM 00091 UM 000A1 UM 000B1 UM 000C1 UM 000D1 UM 000E1 UM 000F1	Range setting For RTD input unit	H1	Select the input range.	
			0001h	RTD input Pt100-1 (-100.0 to 200.0 °C)
			0002h	RTD input Pt100-2 (-200.0 to 650.0 °C)
			0003h	RTD input JPt100-1 (-100.0 to 200.0 °C)
			0004h	RTD input JPt100-2 (-100.0 to 200.0 °C)
			0005h	RTD input Pt1000 (-100.0 to 100.0 °C)

(Note) The unit memory numbers in the above table are listed for CH0 to CH7 in numerical order.

■ Individual setting area per channel

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Default</th><th>Setting range and description</th></tr>
<tr><td>UM 00082
UM 00092
UM 000A2
UM 000B2
UM 000C2
UM 000D2
UM 000E2
UM 000F2</td><td>Function setting 1
Average processing
Offset/Gain Processing
Scale conversion</td><td>H0</td><td>Select the desired function to be used.
<table>
<tr><th>bit</th><th>Name</th><th>Settings</th></tr>
<tr><td>3-0</td><td>Average processing</td><td>H0 Not execute
H1 No. of averaging times
H2 Time average
H3 Moving average</td></tr>
<tr><td>7-4</td><td>Offset/Gain Processing</td><td>H0 Not execute
H1 Execute</td></tr>
<tr><td>11-8</td><td>Scale conversion</td><td>H0 Not execute
H1 Execute</td></tr>
<tr><td>15-12</td><td>Not used</td><td></td></tr>
</table></td></tr>
<tr><td>UM 00083
UM 00093
UM 000A3
UM 000B3
UM 000C3
UM 000D3
UM 000E3
UM 000F3</td><td>Function setting 2
Upper/Lower limit comparison
Holding max./min. values
Disconnection detection
Disconnection detection reset</td><td>H0</td><td>Select the desired function to be used.
<table>
<tr><th>bit</th><th>Name</th><th>Settings</th></tr>
<tr><td>3-0</td><td>Upper/Lower limit comparison</td><td>H0 Not execute
H1 Execute</td></tr>
<tr><td>7-4</td><td>Max./Min. values hold</td><td>H0 Not execute
H1 Execute</td></tr>
<tr><td>11-8</td><td>Disconnection detection</td><td>H0 Not execute
H1 Execute</td></tr>
<tr><td>15-12</td><td>Disconnection detection reset</td><td>H0 Auto (Auto reset for reconnection)
H1 Manual</td></tr>
</table></td></tr>
<tr><td>UM 00084
UM 00094
UM 000A4
UM 000B4
UM 000C4
UM 000D4
UM 000E4
UM 000F4</td><td>Averaging constant</td><td>K200</td><td>Set constants for average processing.
<table>
<tr><th>Function used</th><th>Settings</th><th></th></tr>
<tr><td>No. of averaging times</td><td>No. of averaging times</td><td>2 to 60000 [times]</td></tr>
<tr><td>Time average</td><td>Average time</td><td>200 to 60000 [ms]</td></tr>
<tr><td>Moving average</td><td>No. of moving average</td><td>2 to 2000 [times]</td></tr>
</table></td></tr>
<tr><td>UM 00085
UM 00095
UM 000A5
UM 000B5
UM 000C5
UM 000D5
UM 000E5
UM 000F5</td><td>Offset value</td><td>K0</td><td>Set an offset value at the time of using the offset processing function.
Setting range: -3000 to +3000 (specicfied with a signed integer)</td></tr>
<tr><td>UM 00086
UM 00096
UM 000A6
UM 000B6
UM 000C6
UM 000D6
UM 000E6
UM 000F6</td><td>Gain value</td><td>K10000</td><td>Set an offset value at the time of using the offset processing function.
Setting range: +9000 to +11000 (0.9x to 1.1x: Specified with a signed integer)</td></tr>
</table>

(Note) The unit memory numbers in the above table are listed for CH0 to CH7 in numerical order.

■ **Individual setting area per channel**

Unit memory No. (Hex)	Name	Default	Setting range and description
UM 00087 UM 00097 UM 000A7 UM 000B7 UM 000C7 UM 000D7 UM 000E7 UM 000F7	Scale conversion Max. value	K10000	Set the maximum value at the time of using the scale conversion function. Setting range: -3000 to +30000 (specicfied with a signed integer)
UM 00088 UM 00098 UM 000A8 UM 000B8 UM 000C8 UM 000D8 UM 000E8 UM 000F8	Scale conversion Min. value	K0	Set the minimum value at the time of using the scale conversion function. Setting range: -3000 to +30000 (specicfied with a signed integer)
UM 00089 UM 00099 UM 000A9 UM 000B9 UM 000C9 UM 000D9 UM 000E9 UM 000F9	Upper limit comparison ON level	K1000	Set the upper limit to turn ON the output flag at the time of using the upper/lower limit comparison function. Setting range: -31250 to +31250 (specicfied with a signed integer)
UM 0008A UM 0009A UM 000AA UM 000BA UM 000CA UM 000DA UM 000EA UM 000FA	Upper limit comparison OFF level	K1000	Set the upper limit to turn OFF the output flag at the time of using the upper/lower limit comparison function. Setting range: -31250 to +31250 (specicfied with a signed integer)
UM 0008B UM 0009B UM 000AB UM 000BB UM 000CB UM 000DB UM 000EB UM 000FB	Lower limit comparison OFF level	K0	Set the lower limit to turn OFF the output flag at the time of using the upper/lower limit comparison function. Setting range: -31250 to +31250 (specicfied with a signed integer)
UM 0008C UM 0009C UM 000AC UM 000BC UM 000CC UM 000DC UM 000EC UM 000FC	Lower limit comparison ON level	K0	Set the lower limit to turn ON the output flag at the time of using the upper/lower limit comparison function. Setting range: -31250 to +31250 (specicfied with a signed integer)

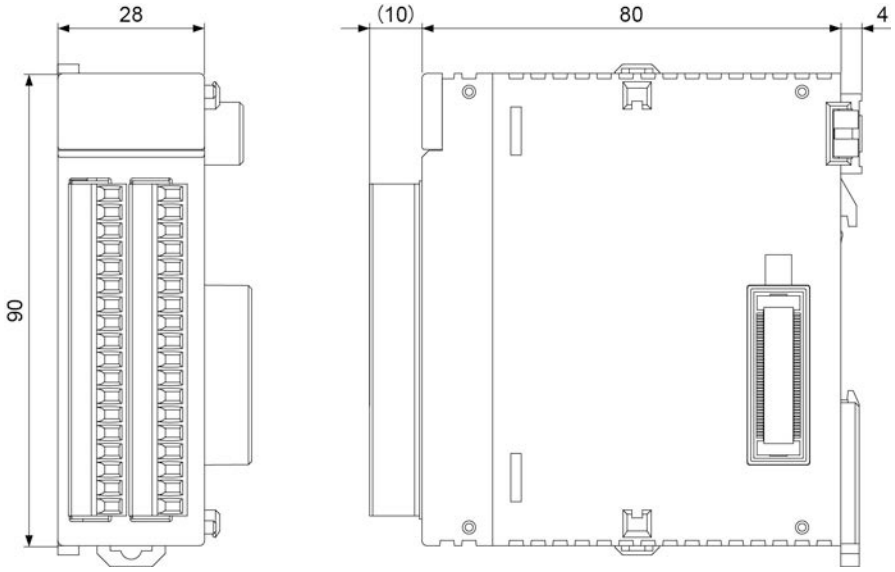
(Note) The unit memory numbers in the above table are listed for CH0 to CH7 in numerical order.

■ **Individual monitor area per channel**

Unit memory No. (Hex)	Name	Default	Data range and description
UM 00170 UM 00171 UM 00172 UM 00173 UM 00174 UM 00175 UM 00176 UM 00177	Holding max. value	K0	The acquired maximum value will be held when the maximum and minimum value hold function is used. Setting range: -31250 to +31250 (specified with a signed integer)
UM 00178 UM 00179 UM 0017A UM 0017B UM 0017C UM 0017D UM 0017E UM 0017F	Holding min. value	K0	The acquired maximum value will be held when the maximum and minimum value hold function is used. Setting range: -31250 to +31250 (specified with a signed integer)

(Note) The unit memory numbers in the above table are listed for CH0 to CH7 in numerical order.

8.5 Dimensions



Unit: mm

Record of changes

Manual No.	Date	Record of Changes
WUME-FP7TCRTD-01	May 2014	First Edition